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PREDICTION OF
WINTER AND SUMMER ANTICYCLONES

Frederick P. Ostby
Keith W. Veigas

December 1965

433L SYSTEM PROGRAM OFFICE
ELECTRONICS SYSTEMS DIVISION
AIR FORCE SYSTEMS COMMAND
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FOREWORD

System 433L; project 1.0, task 1.7. This TR has been prepared for United Aircraft Corporation, East Hartford Conn. under Subcontract no. 15107 to Contract no. AF19(628)-3437, by The Travelers Research Center, Inc., 250 Constitution Plaza, Hartford, Conn. The Research Center's publication number is 7463-191. Robert L. Houghten, Lt. Colonel, USAF, is System Program Director. This report covers the period 1 October 1964—30 September 1965, and was submitted for approval on 18 November, 1965.

ABSTRACT

This report presents results and equations for the 12-, 24-, and 36-hr prediction of anticyclone displacement and change in central pressure for the Northern Hemisphere. Separate sets of equations were derived for each of six areas. These equations yielded results that were generally superior to climatology when tested on independent data.

The technique employed is similar to that used previously in deriving cyclone equations, i.e., it features a moving-coordinate grid system for predictor tabulation, and a screening-regression analysis for the derivation of the prediction equations.

Additional equations were derived for winter anticyclones to specify the forecast difference in pressure between the anticyclone and each of eight surrounding grid points. Analysis of these differences leads to the construction of forecast pressure patterns surrounding the anticyclone center; initial results from feasibility testing were encouraging.

REVIEW AND APPROVAL

Publication of this technical report does not constitute Air Force approval of the report's findings or conclusions. It is published only for the exchange and stimulation of ideas.

Robert L. Houghten
Robert L. Houghten
Lt. Colonel, USAF
System Program Director

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SECTION I

INTRODUCTION

Summer and winter anticyclones in the Northern Hemisphere (divided into six areas) are studied by statistical methods derived for cyclone prediction and reported in [5, 6, 7, 10]. The approach in the cyclone prediction studies was to relate the displacement of a cyclone and its change in central pressure to predictors selected by a screening regression technique within a moving-coordinate system (a coordinate system in which predictor information is measured at points fixed relative to the moving cyclone rather than relative to the earth).

The previous work on cyclones attempted only to specify the pressure at a single point (the central pressure), but the central pressure of an anticyclone by itself may not be particularly meaningful; some indication of the shape and extent of the anticyclone may be needed. Accordingly feasibility tests were conducted in which additional predictands were generated which specified the differences between the pressure maximum of the anticyclone and pressures at surrounding points—thereby permitting the reconstruction of the pressure field in the vincinity of the anticyclone. The results of initial experiments on winter anticyclones are included in this report.

Operational use of the prediction equations derived herein may either be manual, with the aid of a desk calculator, or automatic, as the USAF Global Weather Center (GWC) is using previously-derived equations, with the aid of an electronic computer.

SECTION II

DATA PROCESSING

1. Areas Studied

The areas selected for study are shown in Fig. 1. Both summer- and winter-anticyclone equations were derived for all six areas.

2. Selection of Cases

Anticyclones were processed separately according to the area in which they were located. Table I shows the number of anticyclones selected for each of the areas of Fig. 1. The anticyclones were selected by examining all the 0000 and 1200 GMT surface charts for the winters (November—March) of 1955—56 through 1959—60, and the summers (May—September) of 1955—1959. An anticyclone was accepted if it retained its identity for at least 36 hours.

TABLE I
SELECTED SUMMER AND WINTER ANTICYCLONES, 1955—1960

Area*	No. of Summer anticyclones			No. of Winter anticyclones		
	1955—1958	1959	1955—1959	1955/56—1958/59	1959/1960	1955/56—1959/60
North America	704	124	828	593	140	733
Atlantic	312	65	377	412	94	506
Europe	378	119	497	447	55	502
Eurasia	346	128	474	510	78	588
Asia	412	122	534	446	130	576
Pacific	312	83	395	598	153	751

* See Fig. 1.

The samples of anticyclones selected for the first four winters and summers were designated as the dependent samples and were used to derive prediction equations. The samples of the fifth winter and summer seasons were designated as the independent sample and were used to test the equations.

3. Predictands

The predictands used in this study include the two components of anticyclone displacement (latitudinal and longitudinal) and change in central pressure,

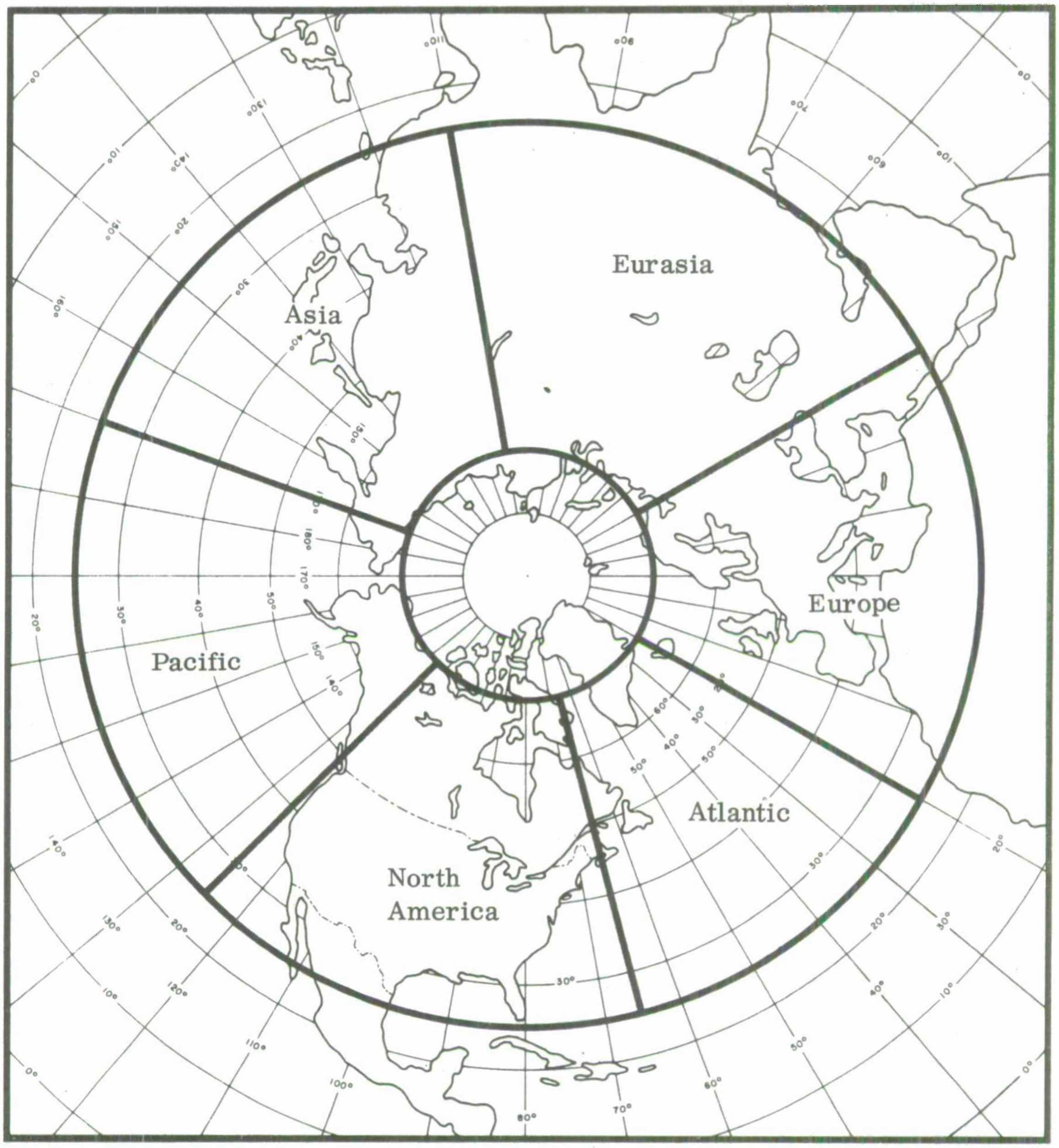

Fig. 1. Definition of anticyclone areas.

for forecast intervals of 12-, 24-, and 36-hr (see Table II). In addition, the differences between the central pressure and pressures one and two grid intervals (one grid interval equals two JNWP grid intervals) outward from the anticyclone center toward the north, east, south, and west, at 12-, 24-, and, 36-hr after initial time were specified as predictands (surrounding pressure minus central pressure) for the winter anticyclones.

TABLE II
PREDICTANDS

Class	Symbol	Unit of measurement
Northward displacement	$\hat{N}$	deg. lat.
Eastward displacement	$\hat{E}$	deg. lat.
Change in central pressure	$\hat{D}$	mb
Pressure difference (one grid interval)	$\hat{\nabla} P_1$	mb
Pressure difference (two grid interval)	$\hat{\nabla} P_1$	mb

4. Predictors Considered

The basic source of predictor data was System 433L hemispheric-data tapes [8]. Special preprocessing programs automatically extracted grid-point arrays of the various pressure, height, and thickness data for each anticyclone in the developmental sample. Inclusion of so-called derived predictors, such as vorticity, thermal wind, thickness advection, etc., did not seem warranted, based on a recent evaluation [7]. Table III lists the possible predictors used in this study.

TABLE III
POSSIBLE PREDICTORS

Prediction	Symbol	
Sea-level pressure	P	mb
12-hr pressure change	ΔP	mb
500-mb height	Z	decafeet
12-hr height change	ΔZ	decafeet
1000-to 500-mb thickness	H	decafeet
12-hr thickness change	ΔH	decafeet
Latitude of anticyclone	Θ	°lat.
Longitude of anticyclone	λ	°long.
Anticyclone intensity (one grid interval)	I_1	mb
Anticyclone intensity (two grid intervals)	I_2	mb

The anticyclone intensity (I) refers to the difference in pressure between the anticyclone's central pressure and the average pressure of four surrounding grid points (derived from one grid interval for I_1 and from two grid intervals for I_2) divided by a function of latitude (map factor), so that

$$I = \left[\left(\frac{1}{4} \sum_{i=1}^{4} P_i \right) - P_0 \right] \div (1 + \sin \Theta)^2 \qquad \text{(II-1)}$$

5. The Moving-coordinate Grid

The grid for extracting predictor information accompanies the anticyclone as it moves, so variables are measured at constant positions relative to its center. The grid is shown in Fig. 2. The grid point defined by the (K,L)-location (5,3) is placed at the center of the anticyclone and the grid is oriented so that the line K=5 coincides with the meridian passing through the center of the anticyclone (i.e., north—south orientation). Other grid locations are defined by their departure, in grid intervals, from this point. For technique development purposes, grid placement and data tabulation are done by computer programs, and "analyzed maps" are on magnetic tape. On a polar stereographic projection with standard parallel at 60°N, the grid array forms a set of evenly—spaced points. The interval used here is twice that of the Joint Numerical Weather Prediction (JNWP) grid. At

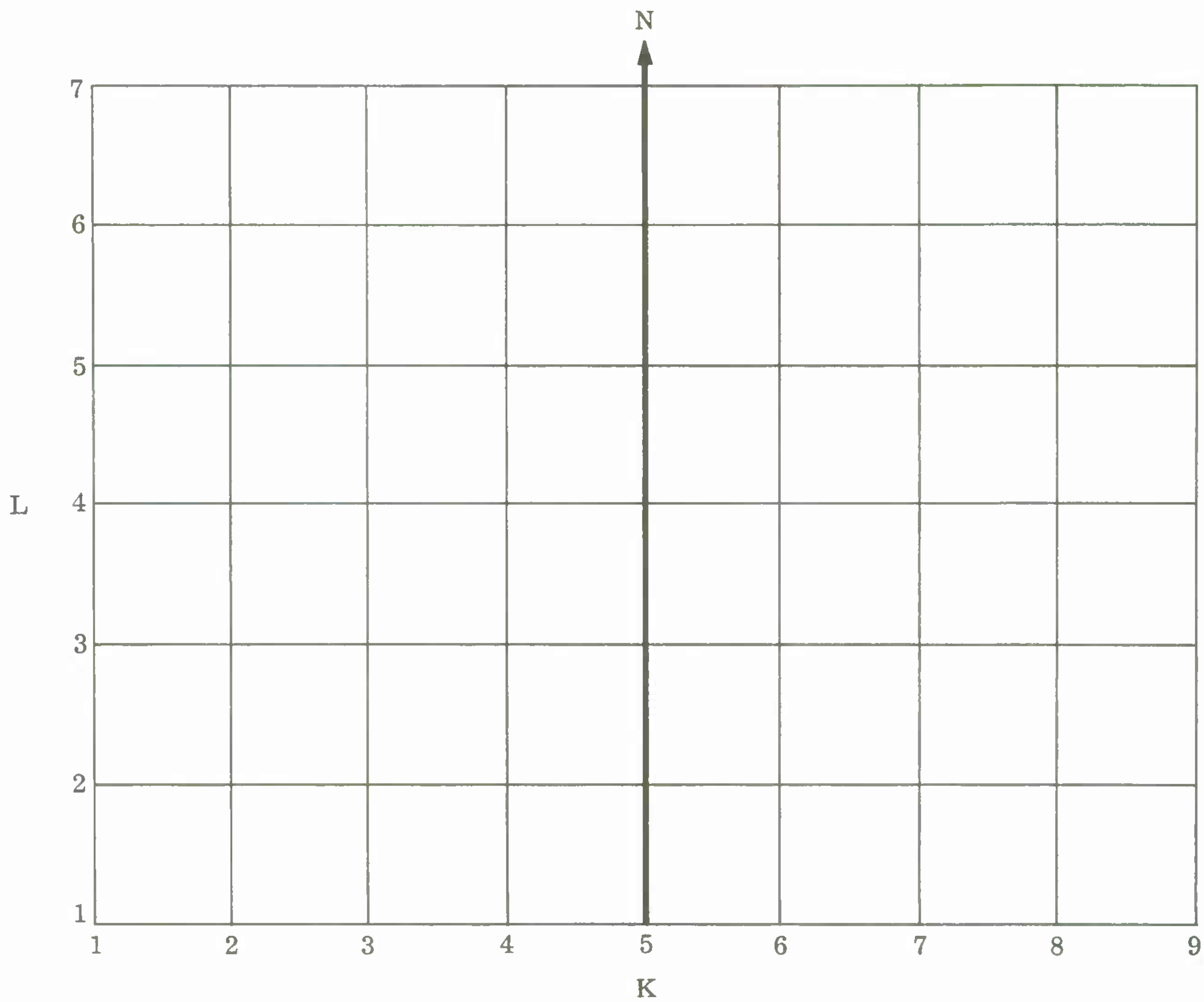

Fig. 2. Moving coordinate grid overlay. The center of the anticyclone is positioned at K=5, L=3 with K=5 oriented north-south. One grid interval equals two JNWP grid intervals (762 km at 60° N).

60°N, where the scale is true, our interval equals 762 km.

6. Screening Regression Technique

The screening procedure suggested by Bryan [1] and developed for the IBM 704 electronic computer by Miller [3] was used to screen the possible predictors identified in previous sections (this program has also been written for the IBM 7094).

One who designs a statistical-prediction experiment invariably likes to consider all predictors deemed important on the basis of previous theoretical, synoptic, and empirical work, but as Lorenz [2] points out, a prediction equation should contain few predictors in comparison with the size of the developmental sample; if there are too many, a relationship that fits the sample used to establish it is likely to fail when applied to a new sample. The object of the screening procedure is to select from a set of possible predictors the subset that most significantly and independently contributes to reducing the variance of the predictand.

From an array of possible predictors, the screening procedure first selects the one that has the highest linear correlation with the predictand in question. The predictor is than held constant and partial-correlation coefficients between the predictand and each of the remaining predictors are examined; the predictor now associated with the highest coefficient is the second one selected. Additional predictors are chosen similarly. Selection is halted whenever a predictor fails to pass a significance test. After the significant predictors have been selected, the regression coefficients are obtained by the method of least squares.

The criterion of significance, as applied to the screening procedure, is not clear-cut because the usual F-test methods (e.g., [9])are not applicable [4].

If a predictor is chosen at random from a group of predictors, an F-test is usually taken at the 95% level; this allows a 1-in-20 chance of considering the predictor significant when, in fact, it is not. Because the screening procedure does not select predictors randomly, a more severe test is needed to specify a 1-in-20 chance. For his screening procedure, Miller [4] suggested that the critical F-value be a function of the number of possible predictors. The F-test was used in this form in these experiments.

SECTION III

SYNOPTIC CLIMATOLOGY

7. Summer Anticyclones

Table IV contains the means and standard deviations of northward and eastward displacements, and the changes in central pressure for 12-, 24-, and 36-hr intervals for the summer anticyclones in the dependent data sample. Mean tracks were also constructed from this information and are shown in Fig. 3. A comparison of these six tracks shows a general west-to-east movement with similar speeds (roughly 15 knots). The mean track for the North American anticyclones had the greatest southward displacement of the six tracks. The only track that exhibited a northward component was the one for Europe. Generally speaking, the changes in central pressure were, in the mean, rather small. The greatest tendency toward building of the anticyclone was over Asia where the mean change in central pressure was +2.51 mb for 36 hr.

8. Winter Anticyclones

Means and standard deviations for winter anticyclones were also computed and are shown in Table V. The mean tracks are shown in Fig. 4. The prevailing direction is once again west to east with the North American mean track showing the greatest southward displacement. However, the speeds vary much more, ranging from 25 knots for Asian anticyclones to 8 knots for European anticyclones. The largest change in central pressure was for Eurasia, being +3.12 mb for 36 hr.

TABLE IV
CHARACTERISTICS OF SUMMER ANTICYCLONES
1955—1958 (dependent sample)

Area	Forecast interval hr	Observed northward displacement deg. lat.		Observed eastward displacement deg. lat.		Observed change in central pressure mb	
		Mean	Std. dev.	Mean	Std. dev.	Mean*	Std. dev.
North America	12	-1.34	2.12	-2.96	2.12	0.03	2.89
	24	-2.45	3.34	-5.99	3.78	-0.09	3.18
	36	-3.33	4.33	-9.08	5.31	-0.25	4.52
Atlantic	12	-0.11	1.98	-3.25	1.88	0.54	2.29
	24	-0.16	3.52	-6.22	3.27	0.82	3.50
	36	-0.17	4.83	-8.83	4.64	0.94	4.53
Europe	12	0.28	2.24	-2.76	2.45	0.01	1.89
	24	0.40	3.73	-5.44	3.89	-0.06	2.76
	36	0.39	4.93	-7.93	5.23	-0.35	3.57
Eurasia	12	-0.54	1.83	-3.12	1.92	0.36	2.69
	24	-1.04	3.00	-5.86	3.25	0.32	3.15
	36	-1.39	3.98	-8.21	4.44	-0.03	4.38
Asia	12	-0.43	2.05	-3.16	2.33	0.91	2.10
	24	-0.78	3.18	-6.43	3.60	1.82	2.85
	36	-1.04	3.97	-9.80	4.72	2.51	3.55
Pacific	12	-0.13	1.69	-3.38	2.11	0.48	2.23
	24	-0.19	2.86	-6.32	3.79	0.65	3.30
	36	-0.34	3.86	-8.72	5.34	0.51	4.41

*Negative values represent deepening.

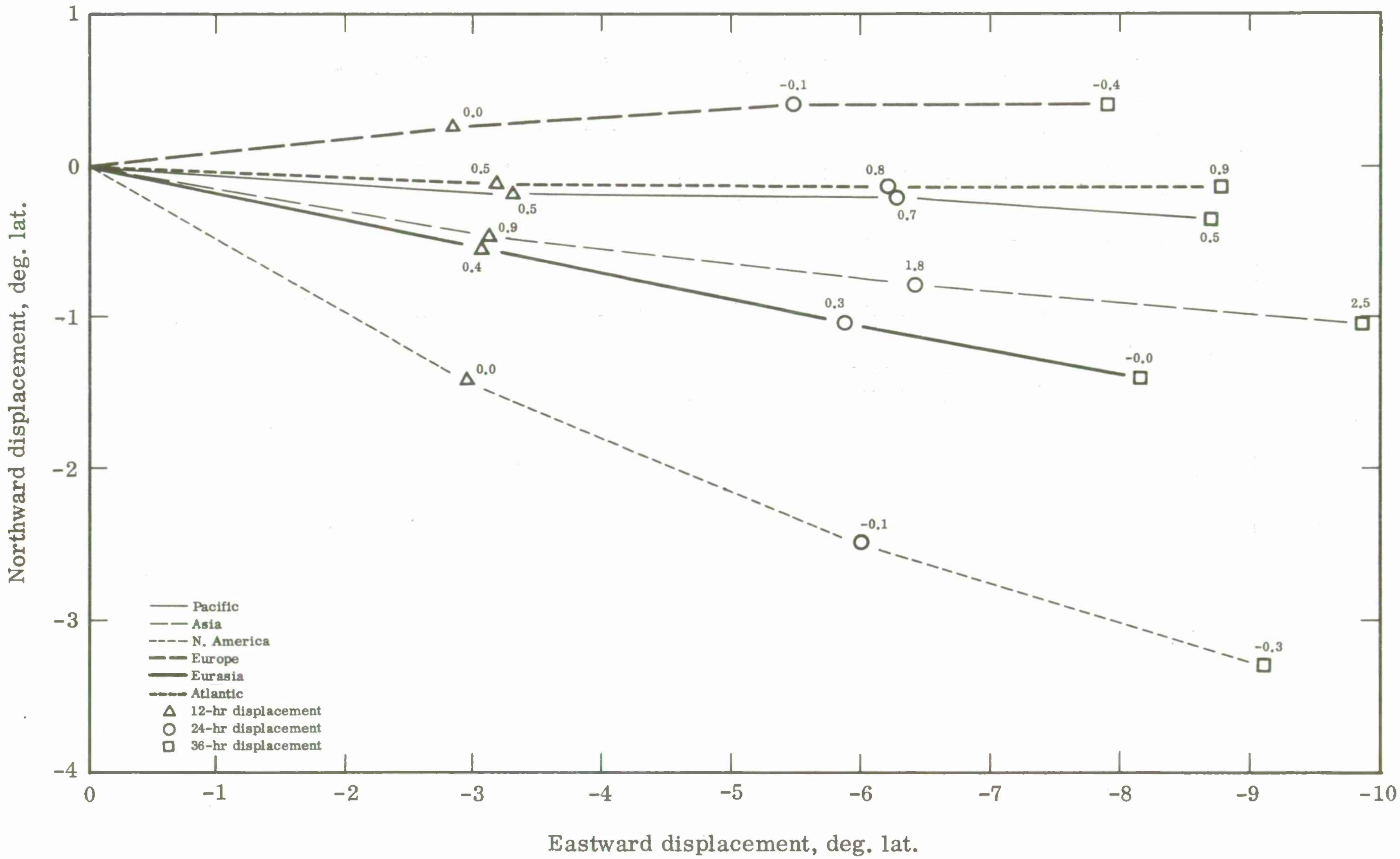

Fig. 3. Mean tracks of summer anticyclones by area, 1955—1958 (dependent sample). Value adjacent to symbol refers to mean change in central pressure (mb).

TABLE V
CHARACTERISTICS OF WINTER ANTICYCLONES
1955/56—1958/59 (dependent sample)

Area	Forecast interval hr	Observed northward displacement deg. lat.		Observed eastward displacement deg. lat.		Observed change in central pressure mb	
		Mean	Std. dev.	Mean	Std. dev.	Mean*	Std. dev.
North America	12	-1.31	2.51	-3.48	2.14	0.09	2.96
	24	-2.29	4.29	-7.15	3.95	-0.22	4.55
	36	-3.07	5.46	-10.85	5.72	-0.74	6.02
Atlantic	12	-0.05	2.23	-3.80	2.50	0.38	2.60
	24	-0.03	3.85	-6.97	4.31	0.52	3.89
	36	0.08	4.97	-9.66	5.91	0.34	5.02
Europe	12	-0.61	2.15	-1.63	2.48	0.49	3.84
	24	-1.20	3.34	-3.34	4.53	0.77	5.07
	36	-1.71	4.27	-4.96	6.49	0.76	6.35
Eurasia	12	-0.11	2.05	-3.63	2.57	1.64	3.77
	24	-0.29	3.45	-7.08	4.22	2.67	5.60
	36	-0.49	4.55	-10.22	5.64	3.12	7.63
Asia	12	-0.49	2.47	-4.95	2.84	-0.22	2.94
	24	-0.90	4.12	-9.77	4.60	-0.59	4.23
	36	-1.18	5.58	-14.42	6.19	-0.84	5.47
Pacific	12	0.08	2.32	-3.77	2.39	0.91	2.92
	24	0.06	3.98	-7.15	4.23	1.49	4.49
	36	-0.16	5.38	-10.12	5.99	1.65	5.83

*Negative values represent deepening.

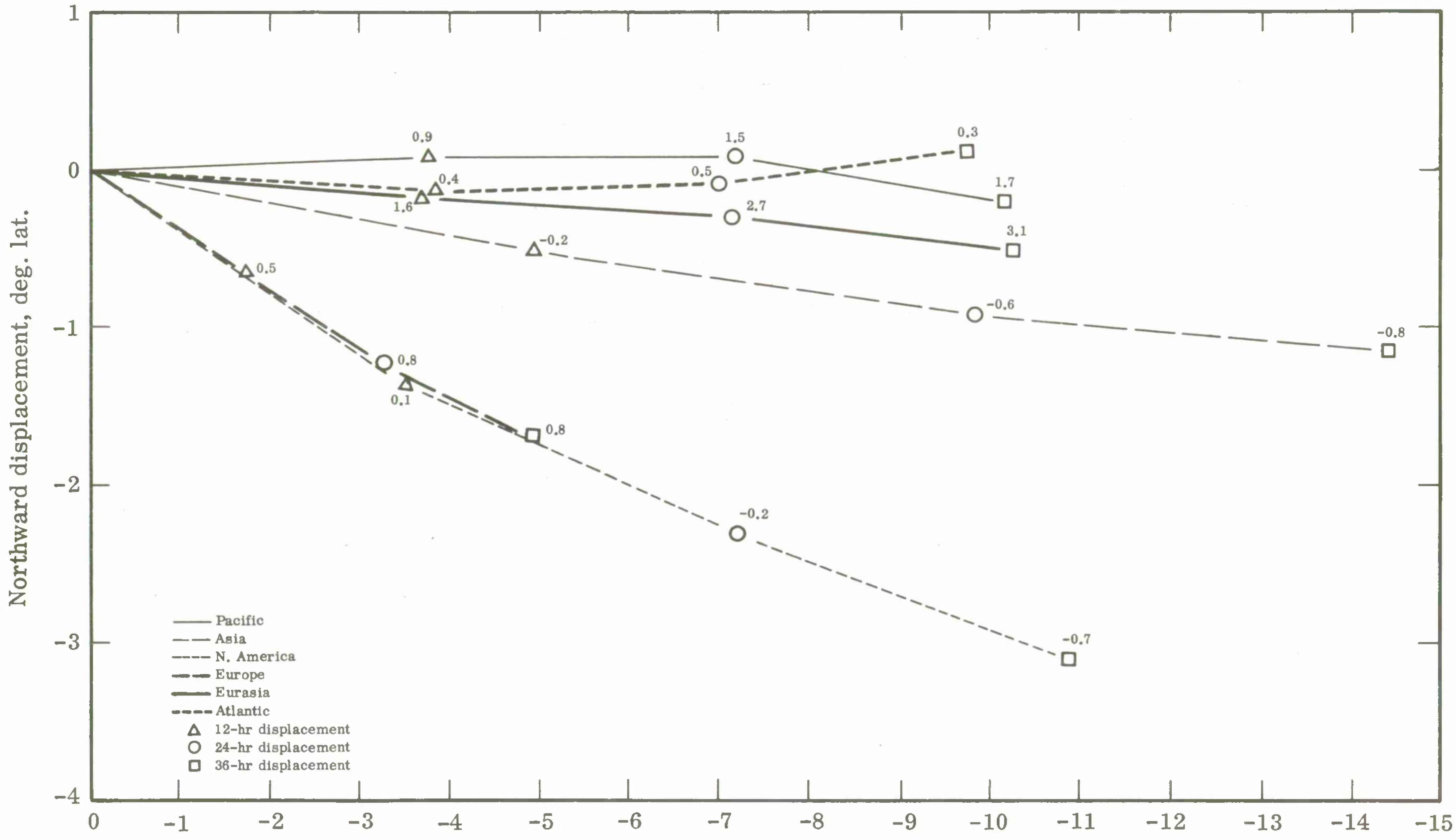

Fig. 4. Mean tracks of winter anticyclones by area, 1955—56 through 1958—59 (dependent sample). Value adjacent to symbol refers to mean change in central pressure (mb).

SECTION IV

RESULTS

For both summer and winter anticyclones, experiments were designed using the predictors listed in Table III to yield separate equations for the two components of displacement (northward, N, and eastward, E) and one equation for change in central pressure (D). In addition, prediction equations were developed for winter anticyclones for the surrounding pressure gradients as listed in Table II.

The results of the screening regression analysis are summarized in Tables VI through XI for each summer area and in Tables XIII through XVIII for each winter area. The equation for each predictand (defined in Table II) is contained in the first three columns. For example, in Table VI, the 12-hr northward displacement (N_{12}) has eight terms: a constant (+32.629) and seven predictors. The predictor symbol (and its units) is defined in Table II and the accompanying numbers in parentheses refer to the (K,L)-grid locations shown in Fig. 2. Thus, this type of representation is equivalent to the more familiar form,

$$N_{12} = 32.629 + 0.01422Z(7,2) + 0.15685\Delta P(5,4)\ldots\text{etc.},.$$

The predictor Z(7.2) explains 23.5% of the variance of the predictand as indicated under the column "Accumulative % red.," and the predictor $\Delta P(5,4)$ contributes an additional 3.5% to the accumulated per cent reduction. The residual error is 1.66° lat.

The convention used for eastward displacement is that negative values of E refer to eastward displacement and positive values to westward displacement. To convert the eastward displacement from degrees of latitude to degrees of longitude, it is only necessary to multiply the computed value of E by the secant of the average latitude applicable to the forecast interval being considered.

9. Summer Anticyclones

Tables VI through XI give the dependent data results for the six summer-anticyclone areas. For northward displacement the first predictor selected is generally a 500-mb height or 1000—500-mb thickness value to the east (ranging from northeast to southeast) of the anticyclone. The regression

coefficients associated with these first predictors relate large 500-mb heights (or thicknesses) with northward displacement. Such a relationship seems to represent the directional nature of the mid-tropospheric flow, i.e., large heights to the east suggest a large amplitude ridge in that region with southerly flow over the anticyclone favoring its northward displacement. It is interesting to note that similar first predictors were selected for summer cyclone northward displacement [7].

For eastward displacement, sea-level pressures were dominant factors except over North America (Table VI) where Z(6,5) was selected first for all three forecast intervals. This predictor, located to the north-northeast of the anticyclone (see Fig. 2), represents a measure of the strength of the zonal flow over the anticyclone and large heights imply a northward shift of the westerlies and, thus, a weak zonal flow over the anticyclone; the stronger the zonal flow, the larger the eastward displacement of the anticyclone. The current latitude of the anticyclone, θ, is an important predictor over Asia. It is of lesser importance, but still selected, over Europe (Table VIII), Eurasia (Table IX), and Pacific (Table XI). In all instances, the sign of the coefficients indicates a relationship of westward-moving anticyclones (or small eastward) with high latitudes and more rapid eastward movement at lower latitudes.

The first predictor selected for change in central pressure varied from area to area but was frequently a function of the initial central pressure: P(5,3), I_1, I_2, etc. When this was the case, the sign of the regression coefficient indicates that anticyclones with initially high central pressure would not build as much as those which initially had lower central pressures.

The regression equations described above were applied to a set of independent data composed of 1959 summer anticyclones cases. An evaluation of the results and a comparison with climatology are shown in Table XII. Of the 54 predictand classes the regression equations yielded smaller root-mean-square errors than climatology with only two exceptions: 24-hr change in central pressure for Atlantic and 24-hr northward displacement for Europe.

TABLE VI

NORTH AMERICAN SUMMER—ANTICYCLONE EQUATIONS WITH DEVELOPMENTAL DATA—SAMPLE STATISTICS (704 Cases)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{N}_{12}$	+ 32.629	1	—	1.66°lat
	+ 0.014122	Z(7,2)	23.5	
	+ 0.15685	ΔP(5,4)	27.0	
	- 0.18873	ΔP(5,2)	29.8	
	-0.038024	ΔH(5,2)	31.6	
	- 0.025945	Z(4,3)	33.2	
	+ 0.022192	Z(6,3)	36.6	
	- 0.051903	P(1,1)	38.6	
$\hat{E}_{12}$	+ 70.428	1	—	1.61°lat
	+ 0.016228	Z(6,5)	16.9	
	- 0.040156	H(5,2)	25.2	
	+ 0.028493	Z(4,3)	30.7	
	- 0.17234	ΔP(6,3)	34.7	
	+ 0.12894	ΔP(4,3)	37.0	
	- 0.080100	P(7,2)	39.3	
	+ 0.020571	ΔZ(4,5)	40.7	
	- 0.015017	ΔZ(9,7)	41.9	

TABLE VI (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{D}_{12}$	+ 113.48	1	—	1.77 mb
	+ 0.064206	ΔH(4,3)	27.4	
	+ 1.0558	I_2	38.7	
	- 0.17490	ΔP(2,3)	43.8	
	+ 0.060884	ΔZ(5,4)	47.9	
	+ 0.056445	ΔH(5,2)	52.3	
	- 0.019078	Z(4,3)	55.8	
	- 0.10884	P(5,2)	58.2	
	- 0.019508	ΔH(9,7)	59.2	
	+ 0.051049	P(9,4)	60.1	
	+ 0.025818	ΔH(2,5)	60.8	
	+ 0.022729	ΔZ(1,7)	61.6	
	- 0.0083589	Z(1,4)	62.4	
$\hat{N}_{24}$	+ 6.9169	1	—	2.32°lat
	+ 0.031273	Z(7,2)	34.1	
	- 0.063732	Z(4,3)	38.0	
	+ 0.037878	H(6,3)	42.8	
	- 0.10584	Θ	45.6	
	+ 0.085833	ΔP(6,5)	46.9	
	- 0.052644	P(3,6)	47.9	
	- 0.047028	ΔZ(5,2)	48.9	
	+ 0.31171	P(5,4)	50.0	
	- 0.069854	P(5,6)	50.9	
	- 0.20062	P(5,3)	51.9	

TABLE VI (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{E}_{24}$	+ 131.49	1	—	2.78°lat
	+ 0.035367	Z(6,5)	21.3	
	- 0.071366	H(5,2)	30.0	
	+ 0.048049	Z(4,3)	34.7	
	- 0.28229	ΔP(6,3)	37.7	
	+ 0.25304	ΔP(4,3)	40.6	
	- 0.15608	P(7,2)	43.2	
	+ 0.048904	ΔZ(4,5)	45.7	
$\hat{D}_{24}$	+ 316.41	1	—	2.22 mb
	+ 0.25086	ΔP(5,4)	11.0	
	- 0.060222	P(2,3)	20.8	
	- 0.053640	P(5,4)	27.1	
	- 0.15170	I_1	32.2	
	- 0.017211	Z(3,6)	38.6	
	-0.033426	Z(4,3)	41.0	
	+ 0.015824	Z(9,4)	44.3	
	+ 0.050021	ΔH(5,4)	45.5	
	+ 1.3415	I_2	47.3	
	+ 0.12404	ΔP(9,4)	48.8	
	- 0.13012	P(4,3)	49.9	
	+ 0.14916	ΔP(6,3)	51.4	

TABLE VI (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{N}_{36}$	− 32.137	1	—	2.88°lat
	+ 0.049061	Z(7,2)	36.0	
	− 0.085631	Z(4,3)	39.6	
	− 0.14133	Θ	45.9	
	+ 0.033472	H(6,3)	48.3	
	+ 0.023792	Z(8,5)	49.8	
	− 0.061318	ΔZ(4,3)	50.9	
	− 0.017240	Z(3,6)	51.9	
	+ 0.023532	H(3,2)	52.6	
	− 0.10197	ΔP(5,6)	53.1	
	− 0.053714	P(7,6)	53.6	
	+ 0.25040	P(5,4)	54.2	
	− 0.20942	P(5,2)	55.7	
$\hat{E}_{36}$	+ 106.52	1	—	3.97°lat
	+ 0.039546	Z(6,5)	22.7	
	− 0.050301	Z(7,2)	30.0	
	+ 0.029091	Z(4,5)	33.0	
	+ 0.12608	ΔZ(4,3)	36.1	
	− 0.084572	ΔZ(6,3)	38.0	
	− 0.12464	P(1,1)	39.9	
	+ 0.21639	ΔP(4,5)	41.2	
	− 0.052232	H(5,2)	42.4	
	+ 0.043637	H(5,4)	44.2	

TABLE VI (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{D}_{36}$	+ 525.32	1	—	3.04 mb
	− 0.43455	P(4,3)	17.2	
	+ 0.35403	I_1	25.8	
	− 0.025743	Z(4,5)	34.1	
	+ 0.070711	ΔH(5,2)	41.1	
	+ 0.049833	ΔH(4,5)	45.4	
	− 0.26003	ΔP(2,3)	48.1	
	+ 0.020148	Z(9,4)	50.0	
	− 0.037254	H(4,3)	51.5	
	+ 1.4774	I_2	53.1	
	+ 0.060251	ΔZ (5,4)	54.8	

TABLE VII

ATLANTIC SUMMER—ANTICYCLONES EQUATIONS WITH DEVELOPMENTAL DATA—SAMPLE STATISTICS (312 Cases)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{N}_{12}$	- 45.717	1	—	1.36°lat
	+ 0.096746	$\Delta P(5,4)$	16.9	
	+ 0.041299	$P(8,5)$	27.4	
	+ 0.040771	$Z(6,3)$	33.3	
	- 0.041367	$Z(4,3)$	46.6	
	- 0.043835	$P(3,6)$	49.7	
	+ 0.048961	$P(6,5)$	52.6	
$\hat{E}_{12}$	- 85.555	1	—	1.51°lat
	+ 0.036106	$P(4,5)$	15.3	
	+ 0.052134	$P(6,5)$	22.7	
	- 0.020007	$H(1,4)$	27.8	
	+ 0.016462	$Z(4,5)$	35.4	
$\hat{D}_{12}$	+ 112.28	1	—	1.61 mb
	+ 0.33879	$\Delta P(5,2)$	12.7	
	+ 0.89947	I_2	24.5	
	+ 0.041306	$\Delta Z(5,4)$	36.3	
	- 0.040917	$P(1,4)$	39.5	
	- 0.053566	$\Delta Z(1,1)$	42.1	
	+ 0.045105	$\Delta H(5,2)$	44.3	
	- 0.013796	$Z(2,5)$	45.8	
	+ 0.056380	$P(9,4)$	47.9	
	- 0.097805	$P(5,2)$	50.2	

TABLE VII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{N}_{24}$	− 128.61	1	—	2.50°lat
	+ 0.13035	P(8,5)	21.5	
	+ 0.075083	Z(6,3)	28.6	
	− 0.076507	Z(4,3)	49.4	
$\hat{E}_{24}$	− 21.831	1	—	2.18°lat
	+ 0.13720	P(5,4)	16.0	
	− 0.092055	P(7,2)	27.9	
	− 0.24608	ΔP(6,3)	35.1	
	+ 0.27495	ΔP(4,3)	39.3	
	− 0.090937	P(8,3)	42.1	
	− 0.16543	ΔP(2,5)	45.1	
	− 0.017645	H(1,7)	47.0	
	+ 0.026587	Z(4,5)	49.6	
	− 0.023900	H(1,4)	52.1	
	+ 0.089785	P(2,5)	55.2	
$\hat{D}_{24}$	+ 325.99	1	—	2.70 mb
	+ 0.12968	ΔZ(5,2)	11.4	
	− 0.42882	P(5,3)	22.4	
	− 0.032991	Z(2,5)	31.0	
	+ 0.17256	P(8,3)	40.6	
$\hat{N}_{36}$	− 182.48	1	—	3.54°lat
	+ 0.18397	P(8,5)	21.6	
	+ 0.096787	Z(6,3)	27.9	
	− 0.098322	Z(4,3)	46.2	

TABLE VII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{E}_{36}$	+ 102.96	1	—	3.27°lat
	+ 0.14769	P(5,4)	15.9	
	- 0.16082	P(8,3)	27.3	
	- 0.30641	ΔP(6,3)	34.6	
	+ 0.055314	Z(4,5)	39.2	
	- 0.029311	H(1,7)	44.6	
	- 0.029959	H(1,4)	48.2	
	-0.046800	Z(9, 1)	50.4	
$\hat{D}_{36}$	+ 470.74	1	—	3.04 mb
	- 1.0165	P(5,3)	15.5	
	- 0.038555	Z(2,5)	23.7	
	+ 0.23030	P(9,4)	34.7	
	+ 0.64198	ΔP(5,2)	38.9	
	+ 0.40625	P(6,3)	42.4	
	- 0.11388	H(1,1)	47.3	
	+ 0.047220	H(9,1)	50.3	
	+ 0.11888	P(6,5)	52.4	
	- 0.50259	ΔP(1,1)	55.0	

TABLE VIII
EUROPEAN SUMMER—ANTICYCLONES EQUATIONS WITH DEVELOPMENTAL DATA—SAMPLE STATISTICS (378 Cases)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{N}_{12}$	- 108.46	1	—	1.91°lat
	+ 0.037813	H(6,3)	11.5	
	- 0.031523	H(4,3)	22.2	
	+ 0.096175	P(1,1)	27.3	
$\hat{E}_{12}$	- 174.35	1	—	2.11°lat
	+ 0.12471	P(5,4)	12.6	
	+ 0.19795	ΔP(4,3)	17.2	
	+ 0.11703	Θ	20.9	
	+ 0.021798	H(4,5)	25.7	
$\hat{D}_{12}$	+ 1.8820	1	—	1.54 mb
	+ 1.3012	I_1	22.1	
	+ 0.17138	ΔP(5,4)	30.1	
	+ 0.035192	ΔZ(5,2)	33.9	
$\hat{N}_{24}$	- 329.14	1	—	2.74°lat
	+ 0.058288	H(6,3)	13.2	
	- 0.065266	H(4,3)	26.6	
	+ 0.17624	P(1,1)	35.8	
	+ 0.034267	Z(9,4)	39.9	
	- 0.33031	ΔP(3,2)	43.1	
	+ 0.098553	P(6,5)	46.0	

TABLE VIII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{E}_{24}$	− 378.22	1	—	3.12°lat
	+ 0.19520	P(5,4)	15.1	
	+ 0.20947	Θ	21.9	
	+ 0.039085	H(4,5)	28.6	
	+ 0.093089	P(7,6)	32.4	
	+ 0.29218	ΔP(4,3)	35.3	
$\hat{D}_{24}$	+ 37.502	1	—	2.25 mb
	+ 1.1036	I_2	13.9	
	+ 0.31431	ΔP(5,4)	28.7	
	− 0.018012	Z(3,2)	33.2	
$\hat{D}_{36}$	− 352.87	1	—	3.79°lat
	+ 0.033203	Z(8,3)	13.5	
	+ 0.31128	P(1,1)	26.0	
	− 0.074109	Z(4,3)	32.3	
	+ 0.061019	Z(6,3)	40.9	
$\hat{E}_{36}$	− 332.14	1	—	4.12°lat
	+ 0.20123	P(6,5)	16.2	
	+ 0.36026	Θ	24.1	
	+ 0.060723	Z(4,5)	30.5	
	+ 0.028298	Z(7,6)	34.1	
	− 0.032586	Z(3,6)	38.1	

TABLE VIII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{D}_{36}$	+ 65.259	1	—	2.75 mb
	+ 0.43021	$\Delta P(5,4)$	16.8	
	+ 1.2695	I_2	29.5	
	− 0.032678	$Z(3,2)$	37.0	
	+ 0.065799	$\Delta Z(5,2)$	40.7	

TABLE IX

EURASIAN SUMMER—ANTICYCLONE EQUATIONS WITH DEVELOPMENTAL DATA—SAMPLE STATISTICS (346 Cases)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{N}_{12}$	- 6.0542	1	—	1.46°lat
	+ 0.010874	Z(7,2)	14.5	
	+ 0.17631	ΔP(5,4)	21.8	
	- 0.043796	ΔP(6,3)	25.2	
	- 0.016099	Z(3,2)	27.5	
	+ 0.014215	Z(6,3)	29.4	
	- 0.088762	ΔP(2,3)	31.3	
	+ 0.062331	P(6,5)	33.1	
	- 0.072375	P(5,2)	36.2	
$\hat{E}_{12}$	- 43.284	1	—	1.59°lat
	+ 0.016992	Z(5,4)	7.9	
	- 0.029432	H(5,2)	19.1	
	+ 0.014993	Z(6,5)	24.9	
	+ 0.098683	Θ	27.7	
	+ 0.016890	H(2,3)	31.7	
$\hat{D}_{12}$	- 1.4193	1	—	2.05 mb
	+ 0.077528	ΔH(4,3)	21.6	
	+ 0.76984	I_2	33.3	
	- 0.22835	ΔP(3,2)	38.6	
	+ 0.077128	Θ	41.9	

TABLE IX (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{N}_{24}$	+ 9.7027	1	—	2.25°lat
	+ 0.027780	Z(7,2)	20.0	
	+ 0.29473	ΔP(5,4)	27.6	
	- 0.081517	ΔP(6,3)	30.6	
	- 0.017580	Z(3,2)	33.4	
	- 0.10922	Θ	35.6	
	+ 0.021665	Z(6,3)	37.0	
	- 0.19350	ΔP(2,3)	38.5	
	- 0.025944	H(2,3)	40.0	
	- 0.098877	P(7,2)	41.7	
	+ 0.083096	P(6,5)	43.9	
$\hat{E}_{24}$	- 259.23	1	—	2.57°lat
	+ 0.079182	P(6,5)	10.5	
	+ 0.038855	H(6,5)	16.6	
	- 0.054615	Z(7,2)	30.2	
	+ 0.16382	P(5,2)	34.4	
	+ 0.022075	H(2,3)	37.5	
$\hat{D}_{24}$	+ 63.410	1	—	2.58 mb
	- 0.032122	Z(2,3)	17.0	
	+ 0.25693	ΔP(5,4)	25.4	
	+ 0.79858	I_2	33.1	

TABLE IX (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{N}_{36}$	− 160.09	1	—	2.98°lat
	+ 0.039614	Z(7,2)	21.9	
	+ 0.33126	ΔP(5,4)	29.3	
	+ 0.13327	P(6,5)	32.0	
	− 0.047650	Z(3,2)	34.8	
	− 0.16049	Θ	37.7	
	+ 0.025912	H(6,3)	39.7	
	+ 0.020089	Z(1,7)	41.4	
	− 0.019632	Z(3,6)	44.0	
$\hat{E}_{36}$	− 241.91	1	—	3.47°lat
	+ 0.17191	P(6,5)	10.7	
	+ 0.053007	H(6,5)	17.4	
	− 0.066703	H(7,2)	33.2	
	+ 0.043710	H(2,3)	35.8	
	+ 0.17356	Θ	38.9	
$\hat{D}_{36}$	+ 404.34	1	—	3.12 mb
	− 0.42147	ΔP(3,2)	13.8	
	− 0.049676	Z(2,3)	23.6	
	− 0.49631	P(5,3)	32.6	
	+ 0.093902	ΔH(2,3)	38.8	
	+ 0.40510	ΔP(5,4)	42.6	
	+ 0.21217	P(3,2)	45.3	
	− 0.042138	H(6,3)	46.9	
	+ 0.031415	Z(5,4)	49.3	

TABLE X

ASIAN SUMMER —ANTICYCLONE EQUATIONS WITH DEVELOPMENTAL DATA—SAMPLE STATISTICS (412 Cases).

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{N}_{12}$	- 40.456	1	—	1.76°lat
	+ 0.021481	Z(6,3)	18.7	
	+ 0.15322	ΔP(5,4)	22.3	
	- 0.041580	ΔZ(5,2)	26.3	
$\hat{E}_{12}$	- 34.838	1	—	1.86°lat
	+ 0.084719	Θ	8.7	
	- 0.10537	ΔP(6,3)	13.5	
	+ 0.012557	Z(5,6)	16.8	
	- 0.018085	H(5,2)	19.5	
	- 0.024580	ΔZ(6,5)	21.5	
	- 0.088506	ΔP(1,4)	22.9	
	+ 0.022017	H(6,3)	24.3	
	- 0.021469	Z(1,4)	25.5	
	+ 0.050442	P(3,2)	26.7	
	- 0.024241	Z(1,1)	28.6	
	+ 0.012861	Z(4,5)	29.9	
	- 0.25920	P(6,3)	31.3	
	+ 0.27054	P(4,3)	36.3	
$\hat{D}_{12}$	+ 2.0079	1	—	1.79 mb
	+ 0.87524	I_2	18.4	
	+ 0.040090	ΔZ(4,3)	23.3	
	- 0.0097634	Z(6,5)	25.1	
	+ 0.010331	H(7,2)	27.4	

TABLE X (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{N}_{24}$	− 22.819	1	—	2.24°lat
	+ 0.031826	Z(6,3)	27.3	
	− 0.15183	Θ	32.3	
	+ 0.23043	ΔP(5, 4)	35.5	
	− 0.047993	ΔZ(5,2)	38.4	
	− 0.036349	Z(3,2)	40.7	
	+ 0.011819	H(1,7)	42.7	
	+ 0.012726	H(9,4)	44.0	
	+ 0.025321	ΔH(5,4)	45.2	
	+ 0.32564	P(5,4)	46.5	
	− 0.24358	P(5,2)	47.9	
	− 0.088918	P(5,6)	50.3	
$\hat{E}_{24}$	+ 44.580	1	—	2.86°lat
	+ 0.15109	Θ	15.6	
	+ 0.035611	Z(4,5)	23.7	
	− 0.051319	H(1,1)	28.1	
	− 0.21565	ΔP(6,3)	31.0	
	+ 0.20204	ΔP(4,3)	32.7	
	− 0.027319	Z(1,4)	34.4	
	+ 0.014947	Z(7,6)	36.6	
$\hat{D}_{24}$	+ 18.534	1	—	2.45 mb
	+ 1.0626	I_2	13.2	
	+ 0.046259	ΔZ(5,4)	19.3	
	− 0.024403	Z(5,4)	23.0	
	+ 0.016894	H(7,2)	25.7	

TABLE X (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{N}_{36}$	− 7.2894	1	—	2.98°lat
	+ 0.042052	Z(7,2)	29.5	
	− 0.19376	Θ	34.8	
	+ 0.016084	Z(9,7)	38.5	
	− 0.064480	H(1,1)	41.8	
	+ 0.015144	Z(8,5)	43.8	
$\hat{E}_{36}$	− 122.26	1	—	3.66°lat
	+ 0.25179	Θ	17.9	
	+ 0.050928	Z(4,5)	27.4	
	− 0.066472	H(1,1)	31.2	
	+ 0.028983	Z(7,6)	34.2	
	− 0.039041	Z(1,4)	36.2	
	− 0.21900	ΔP(6,3)	37.9	
	+ 0.15474	P(3,2)	39.9	
$\hat{D}_{36}$	+ 134.15	1	—	3.01 mb
	+ 1.1864	I_2	9.8	
	− 0.094049	P(4,5)	15.4	
	+ 0.049623	ΔZ(5,4)	19.1	
	− 0.047846	Z(4,3)	23.2	
	+ 0.030533	H(7,2)	27.8	

TABLE XI

PACIFIC SUMMER—ANTICYCLONE EQUATIONS WITH DEVELOPMENTAL DATA—SAMPLE STATISTICS (312 Cases)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
	− 14.672	1	—	
	+ 0.024526	Z(8,3)	9.9	
	− 0.021154	H(2,5)	18.3	
$\hat{N}_{12}$	+ 0.32780	I_2	22.5	1.42°lat
	+ 0.01544	Z(6,5)	25.6	
	− 0.011683	Z(5,6)	29.0	
	− 3.862	1	—	
	− 0.022133	P(9,4)	11.8	
	+ 0.018982	Z(5,6)	16.6	
$\hat{E}_{12}$	− 0.0095888	Z(7,2)	21.2	1.73°lat
	+ 0.18617	P(4,3)	25.2	
	− 0.14814	P(7,2)	29.8	
	+ 0.066626	Θ	32.9	
	+ 91.369	1	—	
	+ 1.1247	I_2	17.1	
$\hat{D}_{12}$	+ 0.18855	ΔP(6,3)	26.0	1.85 mb
	− 0.086436	P(2,3)	31.0	
	− 129.31	1	—	
	+ 0.030294	Z(8,3)	15.1	
	−0.019950	H(2,5)	22.5	
$\hat{N}_{24}$	+ 0.061757	H(6,3)	27.0	2.19°lat
	− 0.054857	Z(5,2)	35.0	
	+ 0.22530	ΔP(5,4)	38.1	
	+ 0.098220	P(6,5)	41.4	

TABLE XI (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{E}_{24}$	− 60.081	1	—	2.88°lat
	− 0.11191	P(9,4)	17.5	
	+ 0.013287	Z(5,6)	23.7	
	− 0.032312	Z(1,4)	28.6	
	+ 0.037573	H(7,6)	31.9	
	+ 0.30043	P(5,4)	36.7	
	− 0.16601	P(7,2)	39.4	
	+ 0.26053	ΔP(3,2)	42.0	
$\hat{D}_{24}$	+ 207.34	1	—	2.24 mb
	− 0.22956	P(5,3)	18.7	
	+ 0.33629	ΔP(6,3)	30.9	
	+ 1.0390	I_2	38.9	
	− 0.039968	Z(3,2)	43.1	
	+ 0.025419	Z(9,4)	47.2	
	− 0.078334	P(2,5)	51.2	
	+ 0.13636	P(7,2)	53.5	
$\hat{N}_{36}$	− 155.02	1	—	2.87°lat
	+ 0.057261	Z(8,3)	19.6	
	− 0.031672	H(2,5)	25.0	
	+ 0.077407	H(6,3)	29.6	
	− 0.075147	Z(5,2)	38.2	
	+ 0.055162	ΔZ(9,7)	41.9	
	+ 0.10404	P(1,4)	44.8	

TABLE XI (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{E}_{36}$	+ 219.97	1	—	3.90°lat
	− 0.32204	P(9,4)	20.5	
	+ 0.036964	Z(5,6)	28.0	
	− 0.12678	P(2,5)	32.7	
	+ 0.13101	P(8,5)	36.0	
	+ 0.26104	Θ	39.8	
	+ 0.045461	H(7,6)	42.3	
	− 0.035678	H(1,7)	46.6	
$\hat{D}_{36}$	+ 546.26	1	—	3.17 mb
	− 0.17240	P(5,3)	25.1	
	+ 0.37814	ΔP(6,3)	32.9	
	+ 1.6065	I_2	38.5	
	− 0.10413	P(2,5)	41.8	
	− 0.25394	P(3,2)	45.7	
	+ 0.062498	ΔZ(8,3)	48.0	

TABLE XII
ROOT-MEAN-SQUARE ERRORS IN TESTS ON
SUMMER ANTICYCLONES, 1959
(independent sample)

Area	Forecast interval, hr	TRC			CLIMATOLOGY		
		N	E	D	N	E	D
North America (124 cases)	12	1.61	1.60	1.95	1.97	2.16	2.86
	24	2.39	2.82	2.06	3.18	3.88	3.03
	36	3.03	3.99	2.95	4.19	5.60	4.30
Atlantic (65 cases)	12	1.75	2.01	1.56	2.39	2.07	2.00
	24	2.69	2.77	2.83	3.85	2.97	2.75
	36	3.83	3.52	3.13	5.02	4.14	3.26
Europe (119 cases)	12	1.77	2.19	1.66	1.86	2.61	1.95
	24	2.77	3.83	2.28	2.72	4.61	3.36
	36	3.10	5.01	2.94	3.56	6.46	3.69
Eurasia (128 cases)	12	1.66	2.01	2.32	2.27	2.36	3.00
	24	2.68	2.83	2.66	4.03	3.93	3.10
	36	3.68	3.64	4.13	5.43	5.36	4.59
Asia (122 cases)	12	1.82	2.31	1.81	1.96	2.66	1.88
	24	2.61	3.76	2.57	2.98	4.54	2.88
	36	3.91	5.16	3.35	4.08	6.25	3.82
Pacific (83 cases)	12	1.62	1.59	1.72	1.78	1.72	2.18
	24	2.50	2.84	2.85	3.26	2.91	3.38
	36	3.98	3.90	3.46	4.51	4.03	4.44

10. Winter Anticyclones

Tables XIII through XVIII give the dependent data results for the six winter-anticyclone areas. The northward displacement predictors are similar to those selected for summer anticyclones in that the first predictors selected are generally upper-air heights (or thicknesses) to the east of the anticyclone. Here again, the equations show that large height values to the east are conducive to northward displacement.

For eastward displacement, a variety of predictors was selected. In North America (Table XIII), $\Delta P(6,3)$ was selected first at the 12-hr interval while $Z(6,1)$ was the most significant predictor for 24 and 36 hr. For the Atlantic, $Z(8,2)$ was selected first for 12 and 24 hr while the initial longitude of the anticyclone was selected first for 36 hr. For Europe, Eurasia, and Pacific, sea-level pressure predictors were important, as was the case for summer in those same areas. For Asia, $Z(7,2)$ and $Z(8,2)$ were the most significant predictors.

The change in central pressure equations have, for their first predictors, a function of sea-level pressure near the anticyclone center. This is similar to the situation with summer anticyclones. As was the case there, the coefficients indicate that the weakest anticyclones are likely to undergo the greatest increase in central pressure.

The experimental gradient predictands, of which there are eight for each forecast interval (24 in all), are also shown in Tables XIII through XVIII. The pressure differences one and two grid units to the north [$\nabla\hat{P}_1$ (N), $\nabla\hat{P}_2$ (N)] have functions of the initial central pressure as the most frequent first predictor selected. Examination of the regression coefficients indicates that strong anticyclones with high central pressures are related to subsequent large spatial pressure differences (note that the gradient predictands are <u>negative</u> for anticyclones, thus higher central pressures are associated with more negative gradients). This seems reasonable since strong anticyclones imply initially sizeable pressure gradients.

Toward the east [$\nabla\hat{P}_1$(E), $\nabla\hat{P}_2$(E)], the initial latitude was a major factor. The regression equations relate anticyclones at northerly latitudes to large pressure gradients and anticyclones at more southerly latitudes to weak pressure

gradients. This is consistent with synoptic experience. Anticyclones in northerly latitudes are observed to have their major axes oriented north—south while at lower latitudes they are oriented more east—west.

The gradients to the south [$\nabla\hat{P}_1(S)$, $\nabla\hat{P}_2(S)$] show some similarity to the northerly directed pressure differences. P(5,3) is the first predictor selected for several of the areas.

To the west [$\nabla\hat{P}_1(W)$, $\nabla\hat{P}_2(W)$], Z(2,3) is often a first selected predictor. This predictor, a 500-mb height located to the west of the anticyclone, has a regression coefficient which relates low heights in that area to large pressure differences to the west. Low heights to the west imply the approach of low surface pressure from the west, and thus large pressure gradients toward that direction.

The reason for specifying these pressure gradient terms is to try to portray the pressure pattern about the anticyclone, rather than merely its location and central pressure. Having forecast these eight pressure differences it is possible to analyze the resulting pressure field as one would analyze a group of pressure observations. An example of this is shown in Fig. 5, which represents a 36-hr forecast of one of the independent cases on winter anticyclones for Pacific. The forecast pressure differences (in mb) are -6, -4, -4, and -5 for one grid interval to the north, east, south, and west, and -16, -8, -11, -10 for the same directions at a distance of two grid intervals. The observed differences were -6, -4, -6, and -6 for one grid interval, and -16, -10, -10, and -13 for two grid intervals. The usefulness of the forecast gradient is enhanced by the good forecast of displacement that was made. Obviously, a good gradient forecast loses its usefulness if the location of the anticyclone is forecast poorly.

The results of applying the winter equations on independent data from the 1959—60 winter season are presented in Table XIX. In comparing these root-mean-square errors with climatology we find that the TRC equations are superior to climatology for 193 of the 198 predictands. The five exceptions are all pressure gradient forecasts: $\nabla\hat{P}_1(S)_{36}$ and $\nabla\hat{P}_1(W)_{36}$ for Eurasia, $\nabla\hat{P}_1(S)_{36}$ for Eurasia; and $\nabla\hat{P}_1(N)_{12}$ and $\nabla\hat{P}_1(N)_{24}$ for Pacific.

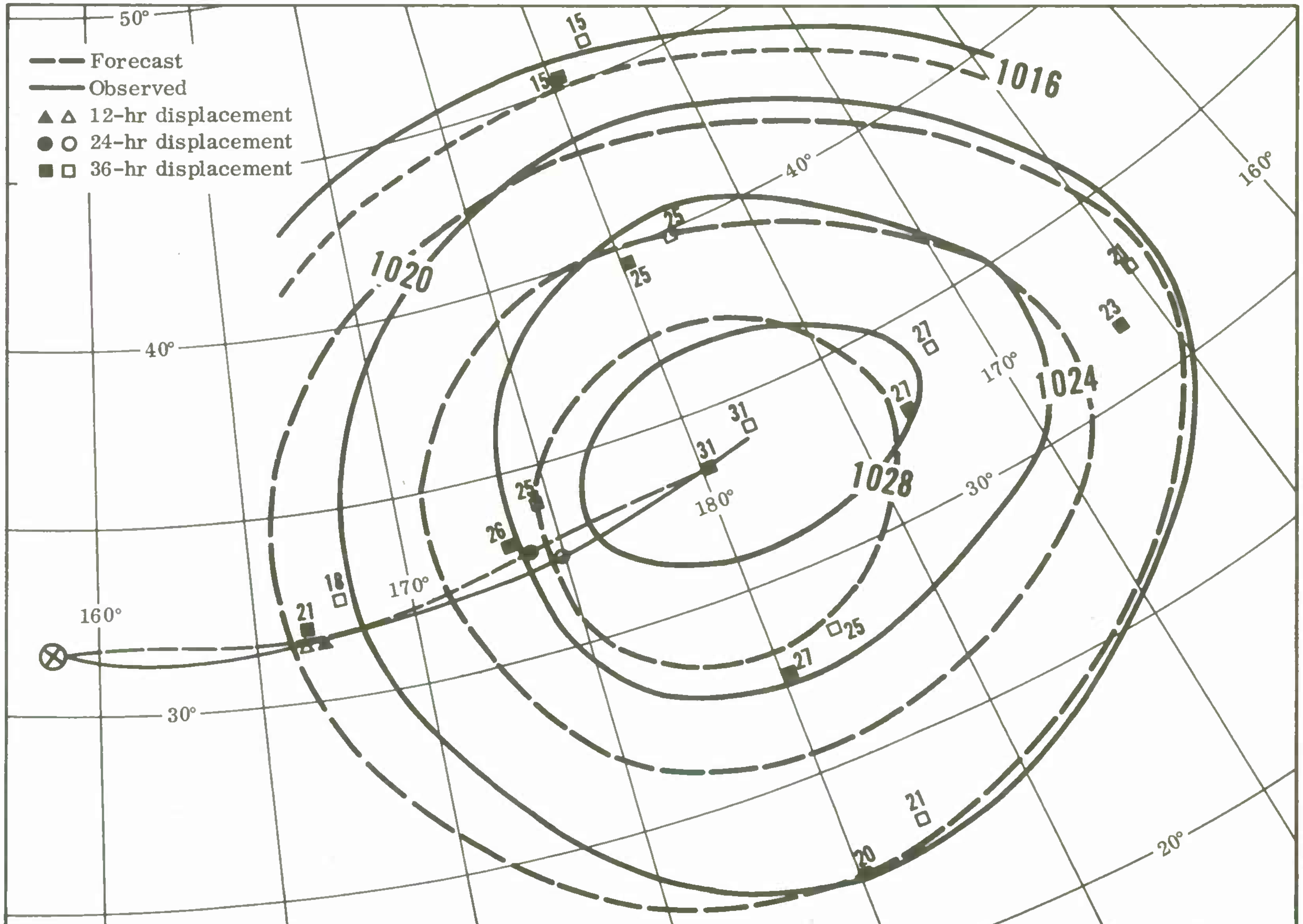

Fig. 5. Example of 36-hr pressure pattern forecast valid at 0000 GMT, 19 Feb 1960. Pressure values are in mb with the thousands and hundreds digits removed. Open squares refer to observed values and filled-in squares refer to forecast values. Observed and forecast displacements for the forecast interval are also included.

TABLE XIII

NORTH AMERICAN WINTER-ANTICYCLONE EQUATIONS WITH DEVELOPMENTAL DATA-SAMPLE STATISTICS (593 cases)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{N}_{12}$	+ 33.187	1	—	1.91 °lat
	+ 0.023184	Z(7, 2)	17.2	
	- 0.019503	Z(2, 3)	26.3	
	- 0.15136	ΔP(5, 2)	31.3	
	+ 0.12564	ΔP(5, 4)	35.4	
	- 0.025646	H(4, 1)	38.3	
	- 0.10411	Θ	40.8	
	+ 0.0060209	Z(8, 5)	42.2	
$\hat{E}_{12}$	- 38.174	1	—	1.67 °lat
	- 0.10721	ΔP(6, 3)	8.6	
	- 0.019118	Z(6, 1)	14.8	
	+ 0.0049955	Z(3, 5)	23.1	
	+ 0.089319	ΔP(3, 4)	27.4	
	+ 0.12015	P(4, 3)	30.0	
	+ 0.010655	H(6, 5)	33.3	
	- 0.076842	P(7, 2)	35.4	
	+ 0.021069	ΔZ(4, 5)	37.8	
	+ 0.023365	ΔZ(3, 2)	39.4	

TABLE XIII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{D}_{12}$	+ 186.05	1	—	2.17 mb
	+ 0.16535	$\Delta P(5,4)$	17.0	
	- 0.15450	$P(5,3)$	24.0	
	+ 0.050464	$\Delta Z(4,3)$	30.4	
	+ 0.092905	$\Delta P(4,5)$	33.1	
	+ 0.056916	$\Delta Z(5,2)$	35.6	
	- 0.0063036	$H(6,5)$	37.7	
	- 0.21589	$\Delta P(2,1)$	39.8	
	+ 0.026902	$\Delta H(2,3)$	41.8	
	+ 0.71503	I_1	43.0	
	+ 0.039027	λ	44.5	
	- 0.010490	$H(3,2)$	46.0	
$\hat{N}_{24}$	- 47.413	1	—	3.08 °lat
	+ 0.032760	$Z(7,2)$	20.9	
	- 0.059595	$Z(3,2)$	30.7	
	+ 0.021842	$H(8,5)$	38.3	
	+ 0.021660	$\Delta H(5,2)$	40.5	
	+ 0.24604	$\Delta P(5,4)$	42.7	
	+ 0.057598	$\Delta P(8,5)$	44.3	
	- 0.20627	$\Delta P(4,3)$	45.8	
	- 0.15298	Θ	46.9	
	+ 0.063214	$P(7,4)$	48.2	

TABLE XIII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{E}_{24}$	+ 14.611	1	—	3.04 °lat
	- 0.018654	Z(6, 1)	10.2	
	+ 0.018129	Z(4, 5)	25.2	
	+ 0.18043	ΔP(3, 4)	31.6	
	- 0.030372	H(5, 2)	33.4	
	+ 0.021394	Z(6, 5)	36.7	
	+ 0.054320	ΔZ(4, 5)	38.9	
	- 0.13700	ΔP(5, 4)	40.6	
$\hat{D}_{24}$	+ 431.26	1	—	3.16 mb
	- 0.050815	P(6, 3)	19.5	
	+ 0.23555	ΔP(5, 4)	32.6	
	+ 0.25419	ΔP(4, 3)	35.9	
	- 0.25794	P(4, 3)	38.5	
	+ 0.062631	ΔP(8, 5)	40.5	
	+ 0.16303	ΔP(4, 5)	42.0	
	- 0.015478	H(6, 5)	43.6	
	- 0.078824	P(4, 5)	45.6	
	+ 0.64363	I_2	47.2	
	+ 0.055437	ΔZ(5, 2)	48.8	
	+ 0.018238	Z(8, 3)	49.6	
	- 0.022181	H(5, 2)	51.6	

TABLE XIII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{N}_{36}$	+ 71.344	1	—	3.83 °lat
	+ 0.018635	H(7, 2)	21.8	
	- 0.024699	Z(3, 2)	29.7	
	+ 0.023786	H(8, 5)	36.6	
	+ 0.14632	P(7, 2)	38.6	
	+ 0.056370	ΔP(8, 5)	40.3	
	- 0.17346	ΔP(3, 4)	41.7	
	- 0.31028	Θ	43.1	
	+ 0.16943	ΔP(5, 4)	45.3	
	- 0.077359	Z(4, 3)	46.5	
	- 0.13953	P(8, 1)	47.6	
	+ 0.020322	H(6, 3)	48.4	
	- 0.054118	H(4, 1)	49.2	
	+ 0.058485	Z(5, 2)	50.8	
$\hat{E}_{36}$	+ 31.606	1	—	4.38 °lat
	- 0.038921	Z(6, 1)	11.8	
	+ 0.036352	Z(4, 5)	28.4	
	+ 0.041117	ΔZ(3, 4)	32.9	
	+ 0.023700	Z(6, 5)	35.5	
	+ 0.15801	ΔP(3, 5)	37.0	
	- 0.040303	H(5, 2)	38.5	
	+ 0.052517	ΔZ(4, 5)	39.9	
	- 0.16187	ΔP(6, 3)	41.4	

TABLE XIII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{D}_{36}$	+ 663.26	1	—	4.34 mb
	- 0.49168	P(5, 3)	28.3	
	+ 0.21911	ΔP(5, 4)	35.4	
	- 0.028690	H(6, 5)	40.1	
	+ 0.14611	ΔP(4, 5)	41.7	
	- 0.091249	P(2, 4)	43.2	
	+ 0.0092120	Z(8, 5)	44.7	
	- 0.037790	H(4, 1)	46.3	
	+ 0.020012	Z(8, 3)	48.0	
$\nabla\hat{P}_1(N)_{12}$	+ 62.812	1	—	2.12 mb
	- 0.70501	I_2	18.6	
	+ 0.036057	P(4, 5)	22.3	
	+ 0.17480	P(4, 3)	29.4	
	+ 0.78099	P(5, 4)	38.3	
	- 0.010553	P(5, 3)	49.8	
$\nabla\hat{P}_1(E)_{12}$	- 20.027	1	—	1.98 mb
	- 0.12893	Θ	40.1	
	- 0.35273	I_2	46.7	
	+ 0.062869	P(7, 2)	49.7	
	- 0.015801	ΔZ(5, 4)	51.9	
	- 0.0067521	P(4, 5)	52.8	
	+ 0.032160	ΔP(7, 4)	53.8	
	- 0.0091369	ΔZ(5, 2)	54.8	
	+ 0.012433	P(2, 5)	55.2	
	+ 0.099972	P(4, 3)	55.8	
	+ 0.52612	P(6, 3)	58.3	
	- 0.67219	P(5, 3)	61.7	

TABLE XIII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_1(S)_{12}$	+ 54.902	1	—	1.98 mb
	+ 0.026220	H(4, 3)	20.9	
	- 0.054321	λ	27.1	
	- 0.018105	H(6, 1)	32.0	
	+ 0.38636	I_2	35.4	
	- 0.065039	P(6, 3)	38.1	
$\nabla\hat{P}_1(W)_{12}$	- 54.948	1	—	2.14 mb
	+ 0.015733	H(6, 3)	23.4	
	+ 0.0038482	P(2, 3)	29.7	
	+ 0.033141	I_2	35.1	
	+ 0.0076124	ΔH(2, 3)	36.8	
	- 0.0080066	Z(7, 4)	38.1	
	- 0.097734	ΔP(5, 4)	39.6	
	+ 0.068767	ΔP(4, 3)	41.1	
	- 0.10479	ΔP(5, 2)	42.5	
	+ 0.080932	P(3, 2)	44.1	
	- 0.014847	P(6, 5)	45.6	
	+ 0.011531	Z(8, 1)	46.6	
	- 0.045714	P(6, 1)	47.5	
	+ 0.37199	P(4, 3)	48.3	
	- 0.37968	P(5, 3)	51.3	
$\nabla\hat{P}_2(N)_{12}$	+ 138.87	1	—	4.47 mb
	- 1.4098	P(5, 3)	17.8	
	+ 0.79388	P(5, 4)	48.2	
	+ 0.25551	P(6, 5)	53.0	
	+ 0.22410	P(4, 5)	58.3	

TABLE XIII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_2(E)_{12}$	- 87.113	1	—	3.85 mb
	+ 0.012682	H(6, 3)	37.5	
	+ 0.23540	P(8, 3)	45.5	
	- 0.59126	P(5, 3)	50.0	
	+ 0.47593	P(7, 2)	57.1	
	- 0.26122	ΔP(5, 4)	61.2	
	+ 0.042157	Z(2, 1)	63.9	
	+ 0.13916	ΔP(7, 2)	65.4	
	- 0.048387	ΔH(4, 3)	66.6	
	+ 0.10525	ΔP(7, 4)	67.4	
	- 0.13904	P(8, 1)	68.0	
	+ 0.040963	ΔZ(2, 3)	68.6	
$\nabla\hat{P}_2(S)_{12}$	+ 87.131	1	—	3.14 mb
	- 1.3496	P(5, 3)	23.0	
	+ 0.91476	P(5, 2)	49.5	
	+ 0.34599	P(6, 1)	55.9	
	- 1.5708	I_1	60.1	
$\nabla\hat{P}_2(W)_{12}$	- 76.275	1	—	3.79 mb
	+ 0.0049597	Z(2, 3)	16.9	
	+ 0.064456	P(5, 4)	26.0	
	+ 0.51024	P(3, 2)	39.4	
	+ 0.15967	P(3, 4)	47.1	
	- 1.0160	P(5, 3)	54.4	
	+ 0.079262	ΔZ(2, 3)	57.2	
	- 0.21608	ΔP(5, 4)	59.0	
	+ 0.34618	P(4, 3)	60.7	

TABLE XIII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_1(N)_{24}$	+ 31.670	1	—	2.62 mb
	+ 0.70416	I_2	16.7	
	+ 0.013260	Z(6, 5)	21.4	
	- 0.13271	P(4, 3)	25.0	
	+ 0.077189	P(4, 5)	28.9	
$\nabla\hat{P}_1(E)_{24}$	- 53.680	1	—	2.45 mb
	- 0.10802	Θ	35.7	
	+ 0.015773	Z(2, 4)	38.3	
	- 0.028263	ΔH(4, 5)	41.0	
	+ 0.39053	I_2	42.8	
	+ 0.013619	Z(6, 1)	44.1	
$\nabla\hat{P}_1(S)_{24}$	+ 14.928	1	—	1.92 mb
	+ 0.021521	H(4, 3)	18.3	
	- 0.025809	λ	22.2	
	- 0.0090331	Z(6, 3)	25.6	
	- 0.063836	P(2, 1)	28.3	
	+ 0.025937	ΔH(4, 1)	30.4	
	+ 0.13377	P(6, 1)	31.8	
	- 0.10732	P(5, 3)	36.2	

TABLE XIII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_1(W)_{24}$	- 84.679	1	—	2.37 mb
	+ 0.023678	H(6, 3)	22.8	
	+ 0.015442	Z(2, 4)	28.0	
	- 0.013382	Z(8, 5)	30.7	
	+ 0.12559	ΔP(7, 4)	32.4	
	- 0.12471	ΔP(5, 2)	34.0	
	+ 0.074092	ΔP(3, 2)	35.4	
	- 0.086850	P(7, 4)	36.6	
	+ 0.066509	P(3, 2)	37.7	
	+ 0.053653	P(8, 5)	38.8	
	+ 0.062519	ΔP(3, 5)	40.0	
$\nabla\hat{P}_2(N)_{24}$	+ 72.874	1	—	5.35 mb
	- 0.67145	P(5, 3)	16.8	
	+ 0.28496	P(6, 5)	30.5	
	+ 0.27100	P(4, 5)	38.8	
	+ 0.024440	H(6, 5)	41.6	
$\nabla\hat{P}_2(E)_{24}$	- 131.38	1	—	4.96 mb
	- 0.13090	Θ	33.3	
	+ 0.043343	Z(2, 3)	36.7	
	+ 0.017920	H(6, 3)	40.0	
	- 0.032613	ΔH(4, 5)	42.1	
	- 0.15420	ΔP(4, 1)	43.3	
	+ 0.26275	P(7, 2)	44.5	
	- 0.24627	P(5, 3)	46.4	
	- 0.21784	ΔP(5, 4)	48.2	

TABLE XIII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla \hat{P}_2(S)_{24}$	+ 86.858	1	—	3.51 mb
	- 0.53774	P(5, 3)	16.1	
	+ 0.30257	P(6, 1)	33.0	
	+ 0.053314	Z(4, 1)	37.1	
	- 0.026721	ΔZ(4, 5)	39.7	
	- 0.15928	ΔP(7, 2)	42.1	
	- 0.029883	H(6, 1)	43.7	
	- 0.061787	λ	45.0	
	- 0.78024	I_1	45.9	
	+ 0.10552	P(3, 4)	46.9	
	- 0.043711	ΔZ(3, 4)	48.0	
$\nabla \hat{P}_2(W)_{24}$	- 44.485	1	—	5.03 mb
	+ 0.035322	H(5, 4)	13.5	
	+ 0.10156	ΔZ(2, 3)	22.2	
	- 0.35117	P(5, 2)	25.3	
	+ 0.32706	P(3, 2)	32.0	
$\nabla \hat{P}_1(N)_{36}$	- 11.939	1	—	2.74 mb
	+ 0.021760	H(6, 5)	12.6	
	+ 0.43273	I_2	16.2	
	- 0.024293	ΔZ(5, 4)	18.5	
	- 0.080521	P(2, 1)	20.1	
	+ 0.018622	H(2, 3)	21.1	
	- 0.015093	H(5, 4)	22.6	
	- 0.035840	ΔZ(3, 4)	24.0	
	+ 0.044967	P(3, 5)	25.8	

TABLE XIII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_1(E)_{36}$	- 66.006	1	—	2.64 mb
	- 0.080583	Θ	31.4	
	+ 0.020196	Z(2, 4)	33.7	
	- 0.058207	λ	37.0	
	- 0.028611	ΔH(4, 5)	39.3	
	+ 0.017840	H(4, 1)	40.8	
$\nabla\hat{P}_1(S)_{36}$	+ 77.387	1	—	1.80 mb
	+ 0.018717	H(4, 3)	15.0	
	- 0.066865	P(2, 1)	20.6	
	- 0.013370	λ	23.1	
	- 0.016118	H(2, 3)	25.3	
	+ 0.022596	ΔH(4, 1)	26.7	
	- 0.0058000	Z(7, 4)	27.9	
	- 0.092500	Θ	29.4	
	- 0.084525	P(6, 3)	31.0	
	+ 0.082229	P(6, 1)	33.3	
$\nabla\hat{P}_1(W)_{36}$	+ 16.213	1	—	2.51 mb
	- 0.16880	Θ	21.2	
	+ 0.017903	ΔZ(2, 3)	23.9	
	- 0.017130	ΔZ(8, 5)	25.9	
	+ 0.022374	H(5, 4)	27.4	
	- 0.023671	H(2, 1)	28.5	
	- 0.0063977	Z(8, 5)	29.5	
	- 0.013792	H(4, 5)	30.4	
	+ 0.014086	Z(2, 3)	31.7	

TABLE XIII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_2(N)_{36}$	+ 73.118	1	—	6.18 mb
	+ 0.043332	Z(6, 5)	15.1	
	- 0.066429	ΔZ(5, 4)	21.2	
	- 0.33258	P(5, 3)	25.1	
	+ 0.18006	P(4, 5)	28.5	
$\nabla\hat{P}_2(E)_{36}$	- 50.548	1	—	5.48 mb
	- 0.20081	Θ	30.3	
	+ 0.048248	Z(2, 3)	34.2	
	- 0.049344	ΔH(4, 5)	36.7	
	- 0.22423	ΔP(4, 1)	38.2	
	+ 0.035865	Z(4, 1)	39.2	
	- 0.10698	P(6, 5)	40.0	
	- 0.19467	ΔP(5, 4)	41.3	
$\nabla\hat{P}_2(S)_{24}$	+ 5.8823	1	—	3.86 mb
	- 0.32857	P(5, 3)	11.3	
	+ 0.28123	P(6, 1)	22.0	
	+ 0.022014	Z(4, 1)	24.5	
	- 0.051126	ΔZ(4, 5)	27.3	
	- 0.18417	ΔP(7, 2)	29.9	
	- 0.051910	λ	31.4	

TABLE XIII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_2(W)_{36}$	+ 178.98	1	—	5.40 mb
	+ 0.047394	H(5, 4)	12.7	
	+ 0.077457	ΔZ(2, 3)	16.9	
	- 0.042694	ΔZ(8, 5)	19.8	
	- 0.25111	P(6, 1)	22.8	
	+ 0.047166	ΔH(6, 3)	25.1	
	+ 0.058776	P(2, 4)	26.0	
	- 0.016854	Z(8, 5)	26.8	
	- 0.022577	H(4, 5)	27.7	
	- 0.14400	Θ	28.8	

TABLE XIV

ATLANTIC WINTER-ANTICYCLONE EQUATIONS WITH DEVELOPMENTAL DATA-SAMPLE STATISTICS (412 cases)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{N}_{12}$	- 14.148	1	—	1.57 °lat
	+ 0.014297	P(8, 5)	18.1	
	+ 0.17718	ΔP(5, 4)	26.0	
	- 0.17047	P(5, 2)	30.3	
	+ 0.077998	P(6, 5)	38.1	
	- 0.031695	ΔZ(3, 2)	42.0	
	+ 0.11464	P(7, 4)	45.6	
	- 0.011664	H(2, 3)	50.5	
$\hat{E}_{12}$	+ 1.9092	1	—	1.72 °lat
	- 0.017650	Z(8, 2)	14.2	
	+ 0.025370	Z(4, 5)	34.8	
	+ 0.20944	ΔP(4, 3)	39.3	
	- 0.19516	I_2	42.2	
	+ 0.046300	ΔP(3, 5)	44.4	
	- 0.088311	ΔP(7, 4)	46.1	
	- 0.023159	H(6, 3)	47.8	
	- 0.021100	λ	48.8	
	+ 0.020452	ΔH(7, 2)	49.7	
	- 0.019041	ΔZ(5, 4)	50.5	
	+ 0.012334	H(2, 3)	51.1	
	+ 0.082778	Θ	52.3	
$\hat{D}_{12}$	+ 2.0969	1	—	2.12 mb
	+ 0.22856	ΔP(5, 4)	17.2	
	+ 1.2745	I_1	33.8	

TABLE XIV (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{N}_{24}$	− 2.8836	1	—	2.82 °lat
	+ 0.013037	Z(8, 5)	21.1	
	− 0.053930	Z(3, 2)	34.5	
	+ 0.044481	Z(7, 4)	43.2	
	+ 0.12197	ΔP(6, 5)	46.3	
$\hat{E}_{24}$	− 21.532	1	—	3.11 °lat
	− 0.041319	Z(8, 2)	15.1	
	+ 0.048600	Z(4, 5)	38.0	
	+ 0.097644	ΔP(3, 5)	41.9	
	+ 0.18636	Θ	45.9	
	+ 0.22581	ΔP(4, 3)	48.0	
$\hat{D}_{24}$	+ 187.19	1	—	3.11 mb
	+ 0.35673	ΔP(5, 4)	18.6	
	− 0.49721	P(5, 3)	30.4	
	+ 0.31689	P(6, 3)	36.0	
$\hat{N}_{36}$	− 19.444	1	—	3.61 °lat
	+ 0.020368	Z(8, 5)	21.4	
	− 0.071879	Z(3, 2)	34.7	
	+ 0.042165	Z(7, 4)	41.0	
	+ 0.13945	ΔP(6, 5)	43.6	
	+ 0.022986	Z(6, 5)	45.2	
	+ 0.22997	ΔP(6, 3)	47.2	

TABLE XIV (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{E}_{36}$	- 63.912	1	—	4.24°lat
	- 0.10608	λ	18.7	
	- 0.038456	Z(8,3)	27.8	
	+ 0.034618	Z(4,5)	39.2	
	+ 0.36546	Θ	43.7	
	+ 0.030551	Z(3,4)	46.7	
	+ 0.29683	ΔP(4,3)	48.6	
$\hat{D}_{36}$	+ 336.03	1	—	3.71 mb
	- 0.54056	P(5,3)	14.3	
	+ 0.11585	ΔP(5,4)	26.5	
	+ 0.24666	P(7,4)	32.9	
	+ 0.35935	ΔP(6,3)	39.0	
	- 0.017742	Z(2,5)	43.0	
	- 0.35080	ΔP(2,1)	45.3	
$\hat{\nabla}P_1(N)_{12}$	+ 80.477	1	—	2.60 mb
	+ 0.010445	Z(4,5)	17.2	
	- 0.58749	P(5,3)	29.0	
	+ 0.48798	P(5,4)	40.8	
$\hat{\nabla}P_1(E)_{12}$	- 1.5911	1	—	2.09 mb
	- 0.11181	Θ	38.7	
	+ 0.053586	P(7,4)	44.0	
	- 0.48933	P(5,3)	48.5	
	+ 0.43962	P(6,3)	55.4	

TABLE XIV (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_1(S)_{12}$	+ 9.1633	1	—	1.81 mb
	- 0.10034	θ	21.7	
	- 0.17003	P(4, 3)	26.9	
	+ 0.16073	P(6, 1)	34.2	
	- 0.015098	Z(8, 3)	37.0	
	+ 0.31708	I_2	39.5	
	+ 0.011654	H(4, 3)	41.5	
$\nabla\hat{P}_1(W)_{12}$	+ 6.6587	1	—	2.51 mb
	+ 0.014192	Z(2, 3)	34.9	
	- 0.16778	P(4, 1)	40.8	
	+ 0.16488	ΔP(8, 2)	42.8	
	+ 0.078217	P(2, 3)	45.0	
	+ 0.013859	H(5, 4)	47.3	
	+ 0.30447	I_2	48.3	
	+ 0.15978	P(3, 2)	49.4	
	- 0.12991	P(5, 4)	51.2	
$\nabla\hat{P}_2(N)_{12}$	+ 48.867	1	—	5.52 mb
	- 0.56289	P(6, 3)	19.5	
	+ 0.46924	P(4, 5)	37.0	
	+ 0.050694	H(4, 5)	49.0	
	+ 0.25101	P(6, 5)	53.1	
	- 0.30068	P(7, 4)	58.3	
$\nabla\hat{P}_2(E)_{12}$	- 19.877	1	—	4.00 mb
	- 0.33757	Θ	43.6	
	+ 0.43581	P(8, 3)	58.9	
	- 0.40820	P(5, 3)	68.3	
$\nabla\hat{P}_2(S)_{12}$	+ 150.90	1	—	2.89 mb
	- 0.76335	P(5, 3)	26.2	
	+ 0.61343	P(6, 1)	65.4	

TABLE XIV (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_2(W)_{12}$	- 130.29	1	—	4.26 mb
	+ 0.045213	Z(2, 4)	50.8	
	+ 0.63233	ΔP(3, 2)	60.3	
	+ 0.35575	P(2, 3)	65.5	
	- 0.31424	P(5, 3)	70.4	
$\nabla\hat{P}_1(N)_{24}$	+ 147.24	1	—	3.05 mb
	- 0.23202	P(5, 3)	13.6	
	+ 0.058191	Z(4, 5)	22.9	
	- 0.040519	H(4, 5)	27.5	
	+ 0.13891	P(2, 2)	32.4	
	- 0.087577	P(7, 4)	35.6	
$\nabla\hat{P}_1(E)_{24}$	+ 3.7455	1	—	2.39 mb
	- 0.21533	θ	34.7	
	+ 0.16191	ΔP(8, 3)	38.4	
$\nabla\hat{P}_1(S)_{24}$	+ 43.937	1	—	2.15 mb
	- 0.10491	θ	22.2	
	- 0.17290	P(5, 3)	26.0	
	+ 0.13061	P(6, 1)	31.2	
$\nabla\hat{P}_1(W)_{24}$	- 44.885	1	—	3.31 mb
	+ 0.037058	Z(2, 3)	24.9	
	- 0.016105	Z(8, 5)	28.0	
	+ 0.17510	ΔP(8, 3)	30.6	

TABLE XIV (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_2(N)_{24}$	+ 270.19	1	—	6.36 mb
	- 0.043522	P(8, 5)	17.1	
	- 0.49956	P(5, 3)	26.4	
	+ 0.31348	P(4, 5)	36.3	
	+ 0.24549	P(6, 5)	42.8	
	- 0.34919	P(7, 4)	45.0	
	+ 0.034203	Z(4, 5)	48.3	
$\nabla\hat{P}_2(E)_{24}$	+ 21.662	1	—	4.61 mb
	- 0.45028	θ	39.1	
	+ 0.16290	P(8, 3)	45.7	
	- 0.18397	P(5, 4)	50.7	
	+ 0.19532	P(7, 4)	52.6	
	- 0.18682	P(6, 5)	55.0	
	- 0.052420	ΔZ(5, 4)	56.4	
$\nabla\hat{P}_2(S)_{24}$	+ 209.79	1	—	3.69 mb
	- 0.71200	P(5, 3)	24.8	
	+ 0.50360	P(6, 1)	48.8	

TABLE XIV (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_2(W)_{24}$	- 287.91	1	—	5.30 mb
	+ 0.060157	Z(2, 4)	39.6	
	+ 0.45062	ΔP(3, 2)	46.9	
	- 0.021876	Z(8, 5)	50.8	
	+ 0.30689	P(2, 2)	53.7	
	+ 0.052049	H(5, 2)	55.3	
	- 0.13803	P(5, 4)	56.5	
	+ 0.14781	ΔP(2, 4)	57.4	
	+ 0.048945	ΔH(4, 1)	58.0	
	- 0.13704	ΔP(6, 5)	58.5	
	- 0.031793	Z(7, 4)	59.0	
	+ 0.21759	ΔP(8, 3)	59.7	
$\nabla\hat{P}_1(N)_{36}$	+ 34.083	1	—	3.72 mb
	- 0.086422	P(8, 5)	9.6	
	+ 0.041089	H(5, 2)	21.1	
	- 0.21295	P(6, 3)	23.9	
	+ 0.097401	P(2, 3)	27.0	
	+ 0.089558	P(4, 5)	29.4	
$\nabla\hat{P}_1(E)_{36}$	+ 4.5108	1	—	2.38 mb
	- 0.22486	θ	31.9	
	- 0.071376	ΔP(6, 5)	33.9	

TABLE XIV (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{\nabla}P_1(S)_{36}$	+ 58.744	1	—	2.50 mb
	- 0.13407	Θ	19.3	
	+ 0.057800	$\Delta Z(2,2)$	23.4	
	- 0.14196	$P(4,3)$	25.9	
	+ 0.085387	$P(7,2)$	28.4	
$\hat{\nabla}P_1(W)_{36}$	- 31.304	1	—	3.46 mb
	+ 0.018860	$Z(2,3)$	21.2	
	- 0.018670	$Z(8,5)$	25.2	
	+ 0.17051	$\Delta P(2,3)$	27.5	
	+ 0.010480	$\Delta P(8,5)$	29.5	
	+ 0.016132	$H(5,2)$	30.7	
	+0.052124	$\Delta Z(3,2)$	31.7	
	- 0.10196	Θ	32.4	
$\hat{\nabla}P_2(N)_{36}$	+ 281.25	1	—	7.43 mb
	- 0.10755	$P(8,5)$	17.2	
	- 0.60256	$P(5,2)$	22.9	
	+ 0.20562	$P(6,5)$	28.8	
	+ 0.42505	$P(4,5)$	33.0	
	+ 0.24615	$\Delta P(2,5)$	35.5	
	+ 0.037720	$H(4,5)$	37.9	
	- 0.27114	$P(7,4)$	40.0	

TABLE XIV (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_2(E)_{36}$	+ 19.245	1	—	4.57 mb
	- 0.61031	Θ	33.8	
	- 0.14159	P(6,5)	38.6	
	+ 0.19881	P(7,4)	41.5	
	- 0.055171	ΔZ(4,5)	44.0	
	- 0.034308	Z(5,4)	46.5	
	- 0.19805	ΔP(6,5)	49.6	
$\nabla\hat{P}_2(S)_{36}$	+ 181.26	1	—	4.22 mb
	- 0.50085	P(5,3)	19.9	
	+ 0.040296	Z(6,1)	35.2	
	+ 0.24377	P(8,1)	40.0	
$\nabla\hat{P}_2(W)_{36}$	- 173.53	1	—	5.91 mb
	+ 0.077441	Z(2,3)	33.5	
	-0.029265	Z(8,5)	41.2	
	+ 0.46122	ΔP(2,2)	45.2	
	- 0.22589	ΔP(6,5)	46.4	
	+ 0.057140	H(6,1)	47.6	
	+ 0.16684	ΔP(2,4)	48.5	
	+ 0.071984	ΔZ(3,2)	49.1	
	+ 0.019457	Z(2,5)	49.8	
	+ 0.25877	ΔP(5,4)	50.3	
	- 0.34735	ΔP(6,3)	50.8	
	- 0.036426	Z(7,4)	52.1	

TABLE XV
EUROPEAN WINTER—ANTICYCLONE EQUATIONS WITH DEVELOPMENTAL DATA—SAMPLE STATISTICS (447 Cases)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{N}_{12}$	− 20.718	1	—	1.81°lat
	+ 0.011460	Z(4,5	16.1	
	+ 0.17048	ΔP(5,4)	24.3	
	− 0.16943	ΔP(5,2)	28.9	
$\hat{E}_{12}$	− 56.974	1	—	1.91°lat
	+ 0.065542	P(4,3)	18.5	
	− 0.022076	Z(6,1)	24.1	
	+ 0.016603	H(5,4)	31.3	
	+ 0.23284	ΔP(4,3)	37.5	
	− 0.12583	ΔP(6,3)	40.2	
$\hat{D}_{12}$	+ 85.197	1	—	1.99 mb
	+ 1.2811	I_1	47.7	
	− 0.018511	Z(5,4)	60.3	
	+ 0.20740	ΔP(5,4)	65.9	
	+ 0.15585	ΔP(5,2)	67.9	
	− 0.048337	P(2,4)	69.3	
	+ 0.087448	ΔP(3,4)	70.7	
	+ 0.025829	ΔZ(7,4)	72.0	
	+ 0.041430	ΔZ(4,3)	73.1	
$\hat{N}_{24}$	− 40.408	1	—	2.73°lat
	+ 0.022256	Z(7,4)	21.2	
	+ 0.26983	ΔP(5,4)	30.0	
	− 0.21332	ΔP(5,2)	33.0	

TABLE XV (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
	- 94.574	1	—	
	+ 0.10134	P(6,3)	22.0	
	+ 0.31076	ΔP(4,3)	29.6	
$\hat{E}_{24}$	-0.037523	Z(6,1)	34.5	3.18°lat
	+ 0.051256	H(5,4)	45.1	
	+ 0.042597	ΔZ(3,4)	47.2	
	- 0.019499	H(8,5)	49.0	
	- 0.13547	ΔP(7,4)	50.9	
	+ 200.95	1	—	
	+ 1.3169	I_1	27.2	
	- 0.026430	Z(5,4)	50.1	
$\hat{D}_{24}$	+ 0.35427	ΔP(5,4)	61.2	2.88 mb
	+ 0.33927	ΔP(4,3)	63.1	
	- 0.12413	P(4,3)	65.2	
	- 0.012528	Z(3,5)	66.7	
	+ 0.12026	ΔP(7,4)	67.9	
	- 157.17	1	—	
	+ 0.027898	Z(7,4)	22.5	
$\hat{N}_{36}$	+ 0.27661	ΔP(5,4)	30.0	3.50°lat
	+ 0.10399	P(8,3)	32.9	

TABLE XV (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{E}_{36}$	− 251.80	1	—	4.76°lat
	+ 0.25035	P(6,3)	24.2	
	+ 0.56065	ΔP(4,3)	30.7	
	− 0.066199	Z(6,1)	35.9	
	+ 0.063628	H(5,4)	46.2	
$\hat{D}_{36}$	+ 446.51	1	—	3.58 mb
	− 0.35687	P(5,3)	30.8	
	− 0.058247	H(3,2)	42.5	
	+ 0.44682	ΔP(5,4)	51.5	
	+ 0.92579	I_1	59.3	
	+ 0.11176	ΔZ(4,3)	63.2	
	+ 0.22470	ΔP(7,4)	65.0	
	− 0.091627	P(2,4)	65.9	
	+ 0.065236	P(2,5)	66.6	
	+ 0.055279	P(8,5)	67.5	
	+ 0.045463	ΔZ(8,1)	68.2	

TABLE XV (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_1(N)_{12}$	+ 1.9544	1	—	2.73 mb
	+0.015054	Z(4,5)	12.9	
	− 0.25874	P(4,3)	23.4	
	+ 0.051931	P(6,5)	26.8	
	− 0.043432	ΔH(5,4)	29.9	
	+ 0.036123	ΔZ(4,5)	32.7	
	+ 0.083083	P(3,4)	34.7	
	− 0.036314	ΔH(2,3)	36.8	
	+ 0.25159	P(5,4)	38.2	
	− 0.084681	Θ	40.0	
	− 0.15683	P(6,3)	41.8	
$\nabla\hat{P}_1(E)_{12}$	− 12.750	1	—	2.30 mb
	+ 0.0086198	Z(7,2)	17.7	
	− 0.028379	ΔZ(5,4)	25.7	
	+ 0.042614	P(2,4)	29.0	
	− 0.67068	P(5,3)	32.2	
	+ 0.62297	P(6,3)	38.4	
	− 0.84773	I_1	50.1	
$\nabla\hat{P}_1(S)_{12}$	− 50.789	1	—	2.25 mb
	+ 0.0095022	H(5, 2)	20.1	
	+ 0.098001	P(6, 1)	24.2	
	− 0.60638	P(5, 3)	33.0	
	+ 0.046417	P(4, 1)	37.8	
	− 0.042479	ΔH(4, 3)	40.0	
	− 0.72799	I_1	42.3	
	+ 0.47244	P(5, 2)	48.5	
	+ 0.011262	Z(3, 4)	50.4	

TABLE XV (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_1(W)_{12}$	− 44.714	1	—	2.51 mb
	+ 0.020678	Z(2,3)	43.2	
	− 0.020444	ΔZ(2,2)	45.9	
	+ 0.065725	P(5,4)	47.8	
	+ 0.53486	P(4,3)	50.4	
	− 0.97251	P(5,3)	52.6	
	− 1.3069	I_1	55.4	
	− 0.14567	ΔP(5,4)	56.7	
	+ 0.19277	P(6,3)	57.8	
	+ 0.18336	P(5,2)	59.0	
$\nabla\hat{P}_2(N)_{12}$	− 84.896	1	—	5.53 mb
	+ 0.47411	P(4,5)	19.8	
	− 0.65517	P(4,3)	44.1	
	− 0.26491	Θ	51.4	
	+ 0.26800	P(6,5)	57.0	
	+ 0.067365	ΔZ (4,5)	59.2	

TABLE XV (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_2(E)_{12}$	+ 93.496	1	—	3.73 mb
	+ 0.021275	Z(7,2)	24.1	
	- 0.076003	ΔP(6,5)	33.5	
	+ 0.17849	ΔP(8,3)	38.9	
	- 0.16920	P(5,2)	44.0	
	+ 0.20893	P(7,4)	53.5	
	+ 0.39141	P(7,2)	59.5	
	- 0.046616	ΔZ(5,4)	62.7	
	- 0.16786	P(8,1)	65.1	
	- 0.96263	P(5,3)	66.5	
	- 1.2236	I_1	67.5	
	+ 0.56591	P(6,3)	69.4	
$\nabla\hat{P}_2(S)_{12}$	- 2.0863	1	—	3.39 mb
	- 0.84648	P(5,3)	25.7	
	+ 0.50177	P(6,1)	50.4	
	+ 0.41803	P(4,1)	58.5	
	- 0.96523	I_1	67.4	
	+ 0.031417	Z(3,4)	70.4	
	- 0.13018	P(3,2)	71.6	
	- 0.063370	ΔZ(4,3)	72.7	

TABLE XV (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_2(W)_{12}$	+ 240.94	1	—	4.11 mb
	+ 0.14007	Z(2,3)	52.8	
	- 0.72953	P(5,3)	60.0	
	- 0.14000	H(2,3)	70.4	
	+ 0.42248	P(3,2)	72.3	
	- 0.85543	I_1	74.9	
	+ 0.050683	Z(3,4)	76.8	
	- 0.017477	Z(7,4)	77.8	
$\nabla\hat{P}_1(N)_{24}$	- 9.2393	1	—	3.10 mb
	- 0.16034	Θ	13.9	
	+ 0.090205	P(4,5)	18.4	
	- 0.079606	P(6,3)	21.1	
$\nabla\hat{P}_1(E)_{24}$	+ 15.049	1	—	2.67 mb
	- 0.14542	Θ	15.4	
	-0.050653	ΔZ(5,4)	21.8	
	+ 0.041479	P(2,5)	24.1	
	- 0.053943	P(4,5)	26.9	

TABLE XV (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{\nabla P}_1(S)_{24}$	− 9.3203	1	—	2.44 mb
	+ 0.0073359	H(5,2)	20.1	
	+ 0.012771	H(2,5)	22.8	
	− 0.013932	H(8,1)	26.3	
	− 0.23720	P(5,3)	28.8	
	+ 0.12826	P(4,1)	31.4	
	− 0.075617	P(2,1)	33.4	
	+ 0.13731	P(6,1)	35.0	
	+ 0.024705	H(5,4)	37.3	
	− 0.28711	I_1	40.5	
$\hat{\nabla P}_1(W)_{24}$	− 77.792	1	—	2.72 mb
	+ 0.033666	Z(2,3)	39.8	
	− 0.14592	ΔP(2,1)	41.9	
	− 0.10793	P(5,3)	43.2	
	+ 0.11929	P(3,2)	45.9	
$\hat{\nabla P}_2(N)_{24}$	− 38.894	1	—	6.45 mb
	+0.027888	H(2,5)	16.9	
	− 0.44392	P(4,3)	22.8	
	+ 0.24007	P(4,5)	30.3	
	− 0.20816	Θ	35.0	
	+ 0.19195	P(6,5)	37.4	
	− 0.066198	ΔZ(2,5)	39.5	
	+ 0.24301	ΔP(4,5)	41.7	

TABLE XV (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_2(E)_{24}$	+ 85.162	1	—	4.55 mb
	- 0.19527	Θ	19.1	
	- 0.10841	$\Delta Z(5,4)$	26.6	
	- 0.31006	$P(5,2)$	32.6	
	+ 0.27210	$P(8,3)$	40.0	
	+ 0.15680	$\Delta P(7,4)$	42.7	
	- 0.29376	$\Delta P(5,2)$	44.1	
	+ 0.20406	$\Delta P(7,2)$	45.3	
	+ 0.033272	$\Delta H(6,5)$	46.5	
	+ 0.045330	$P(2,5)$	47.5	
	-0.12137	$P(4,5)$	48.2	
	+ 0.018714	$Z(3,5)$	49.0	
$\nabla\hat{P}_2(S)_{24}$	+ 19.039	1	—	4.13 mb
	+ 0.015426	$H(5,2)$	24.7	
	- 0.69492	$P(5,3)$	32.5	
	+ 0.37890	$P(6,1)$	41.9	
	+ 0.33109	$P(4,1)$	46.5	
	- 0.85756	I_1	51.3	
	+ 0.032453	$Z(3,4)$	55.1	
	- 0.075859	$\Delta Z(4,3)$	56.7	
	- 0.12366	$P(2,1)$	58.0	

TABLE XV (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_2(W)_{24}$	+ 75.290	1	—	4.99 mb
	+ 0.10478	Z(2, 3)	44.2	
	- 0.089734	P(6, 3)	49.0	
	- 0.056697	H(2, 3)	55.5	
	+ 0.39060	P(3, 2)	57.5	
	- 0.073159	ΔZ(3, 2)	59.2	
	+ 0.028824	Z(3, 5)	60.7	
	+ 0.24707	ΔP(2, 3)	62.0	
	- 0.31334	ΔP(4, 3)	63.1	
	- 0.018065	Z(8, 5)	63.8	
	- 0.48975	P(5, 3)	64.5	
	- 0.69689	I_1	65.8	
$\nabla\hat{P}_1(N)_{36}$	- 6.6926	1	—	3.23 mb
	- 0.13934	θ	11.6	
	- 0.037991	ΔZ(4, 3)	12.9	
	- 0.10427	P(6, 3)	14.4	
	+ 0.11099	P(6, 1)	17.2	

TABLE XV (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_1(E)_{36}$	+ 107.27	1	—	2.51 mb
	- 0.12838	Θ	10.5	
	- 0.051634	$\Delta Z(4,3)$	18.6	
	+ 0.046921	$P(2,4)$	21.9	
	- 0.13942	$P(5,4)$	24.0	
	- 0.10381	$\Delta P(5,2)$	25.3	
	- 0.020438	$\Delta Z(4,5)$	26.4	
	- 0.016357	$\Delta Z(8,5)$	27.5	
	+ 0.022372	$\Delta H(8,3)$	28.5	
	- 0.012100	$H(8,1)$	29.1	
	+ 0.020665	$Z(5,4)$	29.8	
	- 0.015273	$H(6,5)$	31.1	
$\nabla\hat{P}_1(S)_{36}$	-81.378	1	—	2.82 mb
	+ 0.053225	$H(5,2)$	18.6	
	- 0.040516	$\Delta Z(4,3)$	21.3	
	+ 0.015772	$H(2,5)$	23.2	
	- 0.026302	$H(6,1)$	25.8	
$\nabla\hat{P}_1(W)_{36}$	-81.176	1	—	2.82 mb
	+ 0.041073	$Z(2,3)$	32.7	
	- 0.033215	$\Delta H(2,3)$	35.2	
	- 0.16528	$\Delta P(4,3)$	37.1	

TABLE XV (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_2(N)_{36}$	+ 321.67	1	—	7.62 mb
	+ 0.050340	H(2,5)	12.8	
	- 0.28007	P(5,3)	17.3	
	- 0.34662	Θ	19.5	
	- 0.065599	Z(8,1)	23.3	
$\nabla\hat{P}_2(E)_{36}$	+ 75.116	1	—	5.14 mb
	- 0.26304	Θ	14.2	
	- 0.061884	ΔZ(5,4)	19.6	
	- 0.056951	ΔZ(4,5)	22.7	
	- 0.19908	P(5,2)	25.1	
	- 0.10145	ΔZ(4,3)	27.5	
	+ 0.12966	P(8,3)	29.9	
$\nabla\hat{P}_2(S)_{36}$	+ 44.030	1	—	4.66 mb
	- 0.17482	Θ	23.5	
	- 0.11857	P(8,5)	29.6	
	+ 0.036958	ΔH(8,3)	32.3	
	- 0.41032	P(5,3)	34.2	
	+ 0.26140	P(6,1)	39.7	
	+ 0.021188	Z(2,4)	41.3	
	- 0.18349	ΔP(7,4)	42.6	
	- 0.48002	I_1	44.0	
	+ 0.18704	P(4,1)	46.1	

TABLE XV (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{\nabla P}_2(W)_{36}$	− 44.243	1	—	5.77 mb
	+ 0.031910	Z(2,3)	34.7	
	− 0.61117	ΔP(4,3)	38.0	
	− 0.48116	P(6,3)	40.7	
	+ 0.35010	ΔP(2,3)	44.3	
	+ 0.36217	P(3,2)	47.4	
	+ 0.053600	Z(3,4)	50.0	
	+ 0.45196	ΔP(4,1)	51.6	

TABLE XVI

EURASIAN WINTER—ANTICYCLONE EQUATIONS WITH DEVELOPMENTAL DATA—SAMPLE STATISTICS (510 Cases)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{N}_{12}$	- 7.1602	1	—	1.58°lat
	+ 0.011452	H(6,1)	19.0	
	+ 0.13065	ΔP(5,4)	28.1	
	+ 0.057054	P(7,4)	33.2	
	- 0.051407	P(2,3)	35.2	
	- 0.086413	Θ	37.3	
	- 0.0085307	Z(4,3)	39.3	
	- 0.019108	ΔZ(5,2)	40.7	
$\hat{E}_{12}$	- 10.102	1	—	2.11°lat
	+ 0.028298	P(6,5)	13.5	
	- 0.011213	Z(7,2)	18.9	
	+ 0.0065198	Z(6,5)	22.5	
	- 0.029978	ΔZ(5,4)	24.5	
	- 0.033037	ΔP(7,4)	26.0	
	+ 0.014226	Z(4,5)	27.2	
	- 0.0064455	Z(2,5)	28.2	
	- 0.014113	λ	29.0	
	- 0.13625	P(6,3)	30.5	
	+ 0.10928	P(5,3)	32.4	
$\hat{D}_{12}$	+ 33.867	1	—	3.26 mb
	+ 0.83534	I_2	15.7	
	+ 0.060778	ΔZ(5,4)	23.0	
	- 0.015516	Z(2,2)	25.3	

TABLE XVI (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{N}_{24}$	− 3.1042	1	—	2.35°lat
	+ 0.021413	H(6,1)	28.8	
	+ 0.18997	ΔP(5,4)	36.8	
	+ 0.023736	Z(7,4)	42.8	
	− 0.029216	Z(5,2)	46.2	
	− 0.15846	Θ	48.6	
	− 0.10870	ΔP(5,2)	50.2	
	− 0.018815	Z(3,4)	51.4	
	− 0.019814	ΔH(8,3)	52.3	
	− 0.018526	ΔH(6,5)	52.8	
	+ 0.010157	Z(4,5)	53.6	
$\hat{E}_{24}$	− 126.30	1	—	3.43°lat
	+ 0.13506	P(6,5)	17.7	
	− 0.026831	Z(8,2)	24.5	
	+ 0.022205	H(6,5)	28.6	
	− 0.15241	ΔP(6,3)	30.2	
	− 0.11159	P(7,4)	31.7	
	+ 0.10472	P(5,3)	33.7	

TABLE XVI (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{D}_{24}$	+ 172.63	1	—	4.15 mb
	+ 1.2818	I_2	23.0	
	- 0.061283	P(3,5)	29.5	
	+ 0.35285	ΔP(4,3)	34.0	
	- 0.014714	Z(2,3)	37.2	
	+ 0.038884	ΔZ(5,4)	38.8	
	+ 0.034058	λ	40.3	
	- 0.024506	H(6,5)	41.4	
	+ 0.038256	ΔZ(8,5)	42.6	
	- 0.077140	Θ	43.3	
	+ 0.089068	P(8,3)	44.0	
	- 0.11513	P(4,3)	45.0	
$\hat{N}_{36}$	+ 162.34	1	—	2.97°lat
	+ 0.0090245	Z(8,3)	34.6	
	+ 0.18974	ΔP(5,4)	41.0	
	- 0.26906	Θ	46.2	
	- 0.0086636	Z(3,4)	48.9	
	+ 0.026806	Z(7,4)	51.1	
	- 0.18222	P(5,2)	52.9	
	+ 0.090563	P(5,4)	54.4	
	+ 0.098496	ΔP(8,3)	55.4	
	- 0.032537	ΔZ(8,2)	56.0	
	- 0.020897	H(4,3)	56.6	
	- 0.065357	P(2,3)	57.4	

TABLE XVI (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{E}_{36}$	- 41.850	1	—	4.53°lat
	- 0.038740	H(7,2)	19.8	
	+ 0.028194	Z(6,5)	28.1	
	- 0.094231	λ	33.1	
	+ 0.026265	H(4,5)	35.4	
$\hat{D}_{36}$	+ 195.96	1	—	5.71 mb
	+ 1.7379	I_2	25.8	
	- 0.11179	P(3,5)	34.3	
	+ 0.095108	λ	38.6	
	- 0.035073	Z(2,3)	42.2	
	+ 0.062271	ΔZ(5,4)	43.9	
$\nabla\hat{P}_1(N)_{12}$	+ 25.405	1	—	3.45 mb
	- 0.17359	I_2	10.1	
	+ 0.056069	P(4,5)	15.9	
	- 0.072269	P(6,3)	24.1	
	+ 0.58213	P(5,4)	32.8	
	- 0.59489	P(5,3)	37.2	
$\nabla\hat{P}_1(E)_{12}$	- 158.01	1	—	3.48 mb
	+ 0.69941	I_2	12.5	
	+ 0.014804	H(5,4)	19.0	
	+ 0.096237	P(8,3)	21.5	
	+ 0.017010	H(8,1)	25.1	

TABLE XVI (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{\nabla}P_1(S)_{12}$	- 49.821	1	—	3.43 mb
	+ 0.88315	I_2	20.3	
	- 0.20373	P(6,3)	26.5	
	+ 0.20870	P(6,1)	31.7	
	+ 0.022650	Z(2,1)	34.7	
$\hat{\nabla}P_1(W)_{12}$	- 52.369	1	—	3.10 mb
	+ 0.93156	I_2	19.4	
	+ 0.017530	H(8,1)	30.0	
	+ 0.10055	P(3,2)	33.9	
	- 0.16251	P(5,4)	38.1	
	+ 0.26783	P(4,3)	41.8	
	- 0.18815	P(5,2)	44.4	
$\hat{\nabla}P_2(N)_{12}$	+ 31.468	1	—	5.68 mb
	+ 0.57450	P(4,5)	10.9	
	- 0.034038	P(6,3)	29.9	
	+ 0.44350	P(6,5)	40.5	
	- 0.22571	P(3,5)	45.7	
	- 0.58632	P(5,3)	50.4	
	- 0.21025	P(7,4)	52.2	
	- 0.069594	ΔH(5,4)	53.6	
	- 0.29371	ΔP(4,3)	55.0	

TABLE XVI (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_2(E)_{12}$	- 86.481	1	—	4.99 mb
	+ 0.40908	P(8, 3)	18.3	
	- 0.64721	P(5, 3)	43.5	
	+ 0.31939	P(6, 3)	48.9	
	+ 0.039941	H(6, 5)	52.5	
	- 0.046427	ΔZ(5, 4)	53.7	
	- 0.27417	θ	54.7	
	- 0.030709	H(7, 4)	55.9	
	+ 0.054820	λ	57.0	
$\nabla\hat{P}_2(S)_{12}$	+ 63.092	1	—	4.90 mb
	- 0.79831	P(5, 3)	37.3	
	+ 0.48235	P(6, 1)	55.8	
	+ 0.25066	P(4, 1)	58.3	
$\nabla\hat{P}_2(W)_{12}$	- 243.60	1	—	4.44 mb
	+ 0.016304	H(7, 2)	19.0	
	+ 0.18807	P(2, 3)	38.0	
	- 0.85354	P(5, 3)	51.7	
	+ 0.42607	P(3, 2)	59.4	
	+ 0.14242	P(3, 4)	63.1	
	+ 0.30407	P(4, 3)	64.4	

TABLE XVI (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_1(N)_{24}$	+ 50.727	1	—	3.84 mb
	- 0.067962	P(8,3)	4.1	
	+ 0.026903	Z(6,5)	8.7	
	- 0.017466	Z(3,4)	11.0	
	+ 0.11286	P(4,5)	14.0	
	- 0.11708	P(6,3)	17.3	
$\nabla\hat{P}_1(E)_{24}$	- 16.965	1	—	3.53 mb
	+ 0.059511	λ	11.5	
	+ 0.031370	H(5,4)	15.1	
	- 0.022501	H(3,4)	17.4	
$\nabla\hat{P}_1(S)_{24}$	- 24.008	1	—	3.92 mb
	- 0.24129	P(5,3)	10.2	
	+ 0.22063	P(6,1)	15.5	
	+ 0.021705	Z(2,2)	18.7	
$\nabla\hat{P}_1(W)_{24}$	- 46.268	1	—	3.59 mb
	+ 0.023273	H(8,1)	11.8	
	+ 0.65624	I_2	20.1	
$\nabla\hat{P}_2(N)_{24}$	- 254.59	1	—	7.21 mb
	+ 0.36565	P(4,5)	7.9	
	- 0.38416	P(6,3)	16.7	
	+ 0.24160	P(6,5)	21.2	
	- 0.041971	Z(2,5)	24.2	
	+ 0.049100	H(5,2)	28.5	

TABLE XVI (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{\nabla P}_2(E)_{24}$	− 160.59	1	—	6.30 mb
	+ 0.054169	H(6,5)	19.2	
	+ 0.34733	P(8,3)	27.0	
	− 0.28804	P(5,3)	35.3	
$\hat{\nabla P}_2(S)_{24}$	+ 157.95	1	—	5.89 mb
	− 0.68122	P(5,3)	23.6	
	+ 0.45754	P(6,1)	33.2	
	− 0.090087	λ	37.4	
	+ 0.031324	Z(2,2)	39.6	
$\hat{\nabla P}_2(W)_{24}$	− 173.99	1	—	5.42 mb
	− 0.30773	Θ	17.2	
	+ 0.91993	I_2	23.7	
	+ 0.34804	P(2,2)	31.9	
	− 0.29538	P(5,4)	37.8	
	+ 0.12522	P(3,4)	40.0	
$\hat{\nabla P}_1(N)_{36}$	− 207.17	1	—	4.17 mb
	+ 0.10491	P(4,5)	2.1	
	+ 0.048334	H(7,2)	5.1	
	− 0.013661	Z(2,5)	8.0	
	− 0.024602	Z(8,3)	9.5	
	+ 0.021348	Z(6,5)	11.0	
	− 0.018574	H(2,3)	12.6	
	+ 0.20440	P(8,1)	13.6	
	− 0.13572	P(8,2)	14.0	

TABLE XVI (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_1(E)_{36}$	− 38.388	1	—	3.77 mb
	+ 0.051065	λ	10.6	
	+ 0.020465	H(5,4)	14.5	
$\nabla\hat{P}_1(S)_{36}$	+ 55.242	1	—	4.08 mb
	− 0.23164	P(5,4)	6.6	
	− 0.045729	λ	9.9	
	+ 0.022510	Z(6,5)	12.8	
	+ 0.13257	P(2,1)	15.2	
	− 0.10769	P(8,3)	16.1	
	+ 0.10515	P(7,2)	17.3	
$\nabla\hat{P}_1(W)_{36}$	− 50.540	1	—	3.76 mb
	+ 0.024884	H(8,1)	9.7	
	− 0.055537	ΔH(3,2)	12.8	
	+ 0.39617	I_2	15.7	
$\nabla\hat{P}_2(N)_{36}$	− 389.93	1	—	8.10 mb
	+ 0.38146	P(4,5)	6.4	
	+ 0.063209	H(5,2)	10.2	
	− 0.039886	Z(3,5)	16.5	
	− 0.083120	λ	18.3	
	− 0.27889	P(7,2)	19.5	
	+ 0.21601	P(8,1)	20.8	
	+ 0.19491	ΔP(8,5)	21.9	

TABLE XVI (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_2(E)_{36}$	- 71.318	1	—	6.83 mb
	+ 0.02135	H(6,5)	17.4	
	+ 0.078339	λ	23.5	
	+ 0.22807	P(8,3)	26.6	
	- 0.22441	P(5,4)	29.1	
	- 0.17617	ΔP(5,4)	30.5	
	- 0.18898	Θ	31.6	
	+ 0.24832	ΔP(2,3)	32.8	
$\nabla\hat{P}_2(W)_{36}$	+ 40.341	1	—	6.32 mb
	- 0.22361	P(5,4)	16.5	
	- 0.15992	λ	24.1	
	+ 0.076547	H(5,2)	27.3	
	+ 0.31626	P(6,1)	29.8	
	- 0.23834	P(5,3)	31.2	
	- 0.060550	ΔZ(6,1)	32.4	
	+ 0.16773	ΔP(2,4)	33.2	
	- 0.068806	Z(4,1)	33.9	
	+ 0.042387	Z(2.1)	35.1	
$\nabla\hat{P}_2(W)_{36}$	- 119.89	1	—	6.14 mb
	- 0.35249	Θ	14.8	
	+ 0.33367	P(2, 2)	19.9	
	- 0.21190	P(5,4)	25.7	

TABLE XVII

ASIAN WINTER—ANTICYCLONE EQUATIONS WITH DEVELOPMENTAL DATA—SAMPLE STATISTICS (466 Cases)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{N}_{12}$	− 28.273	1	—	2.09°lat
	+ 0.027210	Z(7,4)	21.1	
	− 0.026507	H(4,3)	26.3	
	+ 0.014673	H(7,2)	28.7	
$\hat{E}_{12}$	− 11.960	1	—	2.28°lat
	− 0.16143	Z(7,2)	8.5	
	+ 0.020328	Z(4,5)	17.3	
	+ 0.028721	ΔZ(4,5)	21.1	
	+ 0.10490	ΔP(3,4)	23.7	
	− 0.056242	ΔP(8,3)	25.8	
	+ 0.029455	ΔZ(4,3)	28.0	
	+ 0.15591	P(5,4)	29.4	
	− 0.34015	P(6,3)	33.7	
	+ 0.18546	P(5,3)	35.8	
$\hat{D}_{12}$	+ 161.41	1	—	2.29 mb
	− 0.15244	P(3,4)	12.7	
	+ 0.83175	I_2	22.0	
	− 0.014294	Z(2,2)	29.8	
	+ 0.030942	ΔZ(4,3)	32.5	
	+ 0.045573	P(8,5)	34.4	
	+ 0.059924	ΔP(6,5)	35.7	
	+ 0.13498	ΔP(3,4)	36.4	
	− 0.086990	ΔP(2,4)	37.2	
	− .012664	H(3,4)	37.9	
	− 0.025229	ΔZ(8,2)	38.5	
	+ 0.017218	AH(4,5)	39.3	

TABLE XVII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
	− 157.21	1	—	
	+ 0.035323	Z(8,5)	26.2	
$\hat{N}_{24}$	+ 0.072443	Z(7,2)	30.1	3.17°lat
	− 0.069003	Z(5,2)	38.1	
	+ 0.086886	P(6,5)	40.6	
	+ 45.289	1	—	
	+ 0.0059135	Z(8,2)	13.4	
	+ 0.034024	Z(4, 5)	21.7	
	+ 0.24460	ΔP(5,4)	25.9	
	− 0.16226	ΔP(7,4)	28.8	
$\hat{E}_{24}$	+ 0.30758	P(4,3)	32.2	3.52°lat
	− 0.20947	P(8,3)	34.6	
	− 0.057679	Z(8,1)	37.2	
	− 0.11514	P(2,5)	38.8	
	+ 0.15529	ΔP(3,5)	41.5	
	+ 340.89	1	—	
	− 0.48432	P(5,3)	20.6	
	+ 0.25672	ΔP(5,4)	32.8	3.10 mb
$\hat{D}_{24}$	− 0.029781	H(5,2)	36.3	
	+ 0.20658	P(7,4)	41.4	
	+ 0.31832	ΔP(6,3)	46.4	

TABLE XVII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{N}_{36}$	- 85.976	1	—	4.32°lat
	+ 0.046579	Z(8,5)	27.2	
	+ 0.092848	Z(7,2)	31.8	
	- 0.091029	Z(5,2)	40.0	
$\hat{E}_{36}$	+ 100.36	1	—	4.65°lat
	- 0.079079	Z(8,1)	16.3	
	+ 0.038483	Z(4,5)	24.3	
	+ 0.29085	ΔP(5,4)	28.3	
	+ 0.41345	P(4,3)	31.6	
	- 0.20761	P(8,3)	34.9	
	- 0.23799	P(2,4)	37.5	
	+ 0.26110	ΔP(3,4)	41.2	
	- 0.19322	ΔP(7,4)	43.7	
$\hat{D}_{36}$	+ 372.57	1	—	3.98 mb
	- 0.58342	P(5,3)	28.1	
	- 0.029024	Z(2,5)	35.8	
	+ 0.27309	P(7,4)	41.6	
	+ 0.39544	ΔP(6,3)	46.9	
$\nabla\hat{P}_1(N)_{12}$	+ 49.193	1	—	2.70 mb
	+ 0.68131	I_2	16.3	
	+ 0.017601	Z(4,5)	21.0	
	- 0.082054	P(8,3)	23.6	

TABLE XVII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_1(E)_{12}$	- 185.00	1	—	2.46 mb
	+ 0.0020309	H(6,1)	30.7	
	+ 0.59082	I_2	38.3	
	+ 0.11016	P(8,3)	40.4	
	- 0.065659	P(8,5)	42.2	
	+ 0.020808	H(6,3)	44.0	
	- 0.17260	ΔP(6,1)	45.6	
	+ 0.21481	P(2,1)	46.8	
	- 0.13703	P(3,2)	47.6	
	+ 0.0098468	Z(2,5)	49.0	
$\nabla\hat{P}_1(S)_{12}$	+ 8.9780	1	—	1.99 mb
	+ 0.66184	I_2	26.5	
	+ 0.029313	Z(2,1)	33.3	
	- 0.20128	P(6,3)	38.8	
	+ 0.13609	P(6,1)	42.0	
	- 0.11407	ΔP(4,3)	43.7	
$\nabla\hat{P}_1(W)_{12}$	+ 165.30	1	—	2.31 mb
	+ 0.028826	Z(2,4)	29.2	
	+ 0.62539	I_2	37.9	
	- 0.0087928	Z(6,5)	40.4	
	+ 0.015581	H(6,1)	41.8	
	- 0.088559	H(4,3)	43.5	
	- 0.21500	P(5,4)	44.8	
	+ 0.077986	Z(4,3)	47.2	

TABLE XVII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla \hat{P}_2(N)_{12}$	+ 190.00	1	—	4.30 mb
	+ 0.031639	Z(4, 5)	7.3	
	+ 0.032428	P(8, 3)	16.8	
	+ 0.25452	P(4, 5)	21.5	
	- 0.63283	P(5, 3)	29.0	
	+ 0.44675	P(6, 5)	41.4	
	- 0.30366	P(7, 4)	46.4	
	- 0.024998	H(7, 4)	48.5	
$\nabla \hat{P}_2(E)_{12}$	+ 136.62	1	—	3.72 mb
	+ 0.097659	Z(7, 2)	36.7	
	- 0.56069	P(5, 3)	44.2	
	+ 0.33672	P(8, 3)	55.1	
	- 0.24817	θ	58.6	
	- 0.096252	H(7, 2)	60.7	
	+ 0.088641	P(3, 4)	61.8	
$\nabla \hat{P}_2(S)_{12}$	+ 20.883	1	—	2.68 mb
	- 0.58915	P(5, 3)	30.4	
	+ 0.73981	P(6, 1)	53.0	
	- 0.22656	P(7, 2)	55.0	
	+ 0.027809	Z(2, 1)	57.7	
$\nabla \hat{P}_2(W)_{12}$	- 143.46	1	—	3.74 mb
	+ 0.049884	Z(2, 4)	31.6	
	+ 0.29827	P(2, 3)	44.2	
	- 0.57680	P(5, 3)	58.2	
	+ 0.32185	P(3, 2)	62.1	
	- 0.015789	Z(8, 5)	63.2	
	- 0.32075	P(5, 4)	64.3	
	+ 0.35189	P(4, 3)	65.5	

TABLE XVII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_1(N)_{24}$	− 30.444	1	—	2.64 mb
	+ 0.43916	I_2	9.5	
	+ 0.014987	Z(4,5)	14.4	
$\nabla\hat{P}_1(E)_{24}$	+ 58.394	1	—	2.42 mb
	− 0.11936	Θ	26.4	
	+ 0.37458	I_2	31.0	
	+ 0.015550	Z(2,5)	33.7	
	− 0.083553	P(6,5)	37.8	
$\nabla\hat{P}_1(S)_{24}$	+ 70.009	1	—	2.01 mb
	− 0.41176	P(5,3)	21.3	
	+ 0.32596	P(5,2)	29.6	
	+ 0.0086517	Z(2,5)	32.9	
$\nabla\hat{P}_1(W)_{24}$	− 5.8088	1	—	2.75 mb
	+ 0.033186	Z(2,4)	28.3	
	− 0.057916	P(8,5)	32.4	
	+ 0.32127	I_2	34.2	

TABLE XVII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla \hat{P}_2(N)_{24}$	+ 116.54	1	—	4.80 mb
	− 0.28013	$\Delta P(6,3)$	9.1	
	− 0.028763	$P(8,3)$	13.7	
	+ 0.0083184	$Z(3,5)$	17.3	
	− 0.038831	$Z(2,4)$	19.9	
	+ 0.52460	I_2	22.1	
	+ 0.066656	λ	25.0	
	+ 0.057127	$H(2,1)$	27.3	
	+ 0.25780	$\Delta P(4,5)$	28.5	
	− 0.041670	$Z(7,4)$	30.1	
	+ 0.051373	$Z(4,5)$	31.9	
	− 0.36922	$P(6,3)$	33.0	
	+ 0.22119	$P(6,5)$	36.8	
$\nabla \hat{P}_2(E)_{24}$	− 27.374	1	—	4.30 mb
	− 0.33361	Θ	30.6	
	− 0.20913	$P(6,5)$	36.3	
	+ 0.025925	$Z(2,5)$	40.3	
	+ 0.19305	$P(8,2)$	42.9	
$\nabla \hat{P}_2(S)_{24}$	+ 135.17	1	—	3.28 mb
	− 0.50314	$P(5,3)$	21.1	
	+ 0.45649	$P(6,1)$	32.6	
	+ 0.019145	$Z(2,5)$	36.6	
	− 0.12380	$P(8,3)$	39.7	

TABLE XVII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_2(W)_{24}$	- 356.33	1	—	5.39 mb
	+ 0.074178	Z(2,4)	29.1	
	+ 0.35150	P(2,2)	37.0	
	- 0.14592	P(8,5)	41.9	
$\nabla\hat{P}_1(N)_{36}$	+ 160.52	1	—	2.59 mb
	+ 0.032559	Z(4,5)	6.1	
	- 0.0094745	Z(8,5)	9.2	
	- 0.16257	P(5,3)	12.9	
	- 0.022692	H(5,4)	15.9	
$\nabla\hat{P}_1(E)_{36}$	+ 12.656	1	—	2.44 mb
	+ 0.028554	Z(4,1)	19.3	
	+ 0.017989	Z(2,5)	25.0	
	- 0.086186	P(6,5)	29.0	
	- 0.0091596	Z(8,5)	31.5	
$\nabla\hat{P}_1(S)_{36}$	+ 93.035	1	—	2.17
	+ 0.029118	Z(4,1)	11.7	
	- 0.13077	P(6,3)	16.1	
	- 0.010866	Z(8,5)	21.0	
$\nabla\hat{P}_1(N)_{36}$	- 189.93	1	—	2.83
	+ 0.039261	Z(2,4)	26.2	
	- 0.068290	P(8,5)	30.3	
	+ 0.36105	P(2,1)	33.8	
	- 0.18155	P(2,2)	36.2	

TABLE XVII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_2(N)_{36}$	+ 155.14	1	—	5.50 mb
	- 0.42214	ΔP(6,3)	11.2	
	+ 0.094991	λ	15.0	
	- 0.28441	P(5,3)	19.0	
	+ 0.13716	P(4,5)	21.3	
$\nabla\hat{P}_2(E)_{36}$	- 100.01	1	—	4.32 mb
	+ 0.012948	Z(2,4)	23.4	
	- 0.14746	P(6,5)	31.5	
	+ 0.15494	ΔP(8,2)	33.9	
	+ 0.069828	Z(2,1)	35.5	
	- 0.021598	Z(4,3)	37.5	
	+ 0.038279	Z(2,5)	38.7	
	+ 0.38597	P(6,1)	39.7	
	- 0.33038	P(5,4)	43.6	
$\nabla\hat{P}_2(S)_{36}$	+ 185.08	1	—	3.77 mb
	- 0.21794	P(5,3)	10.9	
	+ 0.025589	Z(2,5)	16.5	
	- 0.015321	Z(8,5)	21.4	
	+ 0.28159	P(6,1)	24.4	
	- 0.26892	P(6,3)	26.7	
$\nabla\hat{P}_2(W)_{36}$	- 469.00	1	—	6.12
	+ 0.085056	Z(2,4)	24.8	
	- 0.031972	Z(8,5)	32.6	
	+ 0.35398	P(2,1)	35.8	

TABLE XVIII

PACIFIC WINTER—ANTICYCLONE EQUATIONS WITH DEVELOPMENTAL DATA—SAMPLE STATISTICS (598 Cases)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{N}_{12}$	- 59.204	1	—	1.66°lat
	+ 0.19560	$\Delta P(5,4)$	21.2	
	+ 0.013935	$Z(7,4)$	36.1	
	- 0.025866	$Z(5,2)$	42.5	
	- 0.10235	$\Delta P(5,2)$	44.7	
	+ 0.051828	$P(6,5)$	46.8	
	+ 0.016869	$H(6,3)$	48.5	
$\hat{E}_{12}$	- 131.53	1	—	2.00°lat
	+ 0.49614	$P(5,3)$	8.9	
	- 0.15409	$\Delta P(6,3)$	15.4	
	- 0.37688	$P(6,3)$	21.2	
	+ 0.53328	I_2	25.1	
	+ 0.014210	$Z(6,5)$	27.5	
	- 0.010376	$Z(5,2)$	30.1	
$\hat{D}_{12}$	- 0.16916	1	—	2.15 mb
	+ 0.17297	$\Delta P(5,4)$	19.0	
	+ 0.15191	$\Delta P(5,2)$	25.7	
	+ 0.88764	I_2	29.5	
	- 0.0095676	$Z(5,2)$	38.3	
	+ 0.076007	$P(8,3)$	40.4	
	+ 0.033619	$\Delta Z(5,2)$	42.3	
	- 0.058857	$P(4,5)$	43.7	
	+ 0.091235	Θ	45.7	

TABLE XVIII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{N}_{24}$	− 27.527	1	—	2.91°lat
	+ 0.051419	Z(7,4)	27.8	
	− 0.035116	Z(4,3)	40.5	
	+ 0.18673	ΔP(6,5)	46.6	
$\hat{E}_{24}$	− 241.15	1	—	3.58°lat
	+ 0.50169	P(5,3)	12.1	
	− 0.23955	ΔP(6,3)	18.4	
	+ 0.098191	P(6,5)	22.2	
	− 0.39973	P(6,3)	25.2	
	+ 0.015930	Z(4,5)	28.4	
$\hat{D}_{24}$	+ 206.56	1	—	3.39 mb
	+ 0.22686	ΔP(5,4)	14.8	
	− 0.029351	Z(5,2)	23.6	
	− 0.25935	P(5,3)	33.0	
	+ 0.23088	ΔP(4,3)	37.0	
	+ 0.066190	ΔZ(5,2)	40.0	
	+ 0.11460	P(8,3)	43.1	
$\hat{N}_{36}$	− 47.550	1	—	4.00°lat
	+ 0.067378	Z(7,4)	30.3	
	− 0.039952	Z(4,3)	38.9	
	+ 0.24613	ΔP(6,5)	44.7	

TABLE XVIII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{E}_{36}$	- 106.14	1	—	4.77°lat
	+ 0.24532	P(5,3)	13.9	
	+ 0.086224	P(6,5)	18.8	
	- 0.28401	ΔP(6,3)	23.0	
	+ 0.0041543	λ	25.6	
	- 0.13542	P(2,4)	27.5	
	+ 0.19611	ΔP(3,4)	30.4	
	- 0.10100	P(8,3)	32.1	
	+ 0.031453	Z(4,5)	33.8	
	- 0.031991	H(6,1)	36.5	
$\hat{D}_{36}$	+ 344.65	1	—	4.23 mb
	- 0.44688	P(4,3)	20.0	
	+ 0.43803	ΔP(4,3)	30.2	
	- 0.016847	H(4,5)	37.8	
	+ 0.18349	P(8,3)	41.2	
	+ 0.80603	I_2	43.7	
	- 0.021059	Z(2,2)	45.5	
	+ 0.23918	ΔP(6,3)	47.4	
$\hat{\nabla} P_1(N)_{12}$	+ 35.954	1	—	3.86 mb
	+ 1.1041	I_2	27.1	
	- 0.19867	ΔP(4,3)	30.4	
	+ 0.020064	Z(6,5)	33.8	
	- 0.36156	P(6,3)	35.6	
	+ 0.28961	P(5,4)	40.1	

TABLE XVIII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_1(E)_{12}$	+ 100.19	1	—	3.39 mb
	− 0.16707	Θ	31.3	
	− 0.19533	P(5,2)	35.9	
	+ 0.078936	P(7,4)	38.2	
	+ 0.011971	Z(2,5)	39.	
$\nabla\hat{P}_1(S)_{12}$	+ 71.096	1	—	3.61 mb
	+ 0.014001	H(6,3)	39.9	
	− 0.38355	P(4,3)	46.0	
	+ 0.22852	P(6,1)	51.0	
	− 0.18441	Θ	53.8	
	− 0.11818	P(8,1)	55.5	
	+ 0.18141	P(5,2)	56.8	
$\nabla\hat{P}_1(W)_{12}$	− 65.726	1	—	3.46 mb
	+ 0.033836	Z(2,3)	43.7	
	+ 0.68384	I_2	47.8	
$\nabla\hat{P}_2(N)_{12}$	− 36.114	1	—	5.12 mb
	+ 1.1355	I_2	16.5	
	+ 0.49376	P(4,5)	25.1	
	− 0.67613	P(6,3)	38.7	
	+ 0.35551	P(6,5)	48.2	
	− 0.18904	P(3,5)	53.9	
	+ 0.026454	H(5,2)	56.1	
	− 0.33847	ΔP(4,3)	57.8	

TABLE XVIII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
	+ 177.61	1	—	
	+ 0.00081677	Z(8,3)	37.8	
	− 0.62811	P(5,3)	51.2	
	+ 0.30170	P(7,4)	59.4	
	+ 0.18125	ΔP(8,3)	64.2	
	− 0.21827	ΔP(5,4)	66.8	
$\nabla\hat{P}_2(E)_{12}$	+ 0.26245	P(8,3)	69.8	3.82 mb
	− 0.058763	Θ	71.3	
	− 0.077132	P(6,5)	71.8	
	− 0.15157	ΔP(5,2)	72.2	
	+ 0.015294	H(2,5)	72.6	
	− 0.060903	P(8,5)	73.0	
	+ 231.53	1	—	
	− 0.66066	P(5,3)	40.8	
$\nabla\hat{P}_2(S)_{12}$	+ 0.59233	P(6,1)	62.4	4.19 mb
	+ 0.039581	Z(4,1)	66.2	
	− 0.23579	P(7,2)	68.8	
	− 171.38	1	—	
	+ 0.016767	Z(2,3)	57.3	
	+ 0.39869	P(2,3)	64.2	
$\nabla\hat{P}_2(W)_{12}$	− 0.93200	P(5,3)	70.8	4.45 mb
	+ 0.55748	P(3,2)	73.8	
	− 0.27565	ΔP(5,4)	75.2	
	+ 0.37259	P(6,3)	76.2	
	+ 0.26063	ΔP(2,2)	76.7	
	− 0.26141	P(2,2)	77.5	

TABLE XVIII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_1(N)_{24}$	+ 76.290	1	—	4.65 mb
	+ 1.0302	I_2	18.7	
	+ 0.025552	Z(6,5)	23.1	
	- 0.12227	P(8,3)	25.9	
$\nabla\hat{P}_1(E)_{24}$	+ 95.474	1	—	3.68 mb
	- 0.010285	Θ	28.4	
	+ 0.024506	Z(2,5)	31.6	
	- 0.40036	P(5,3)	35.7	
	+ 0.043209	P(3,2)	36.8	
	- 0.021015	ΔH(2,5)	37.7	
	+ 0.22831	P(6,3)	38.3	
	- 0.073833	P(8,1)	39.0	
	+ 0.064416	P(4,1)	39.6	
$\nabla\hat{P}_1(S)_{24}$	+ 11.141	1	—	4.32 mb
	- 0.26527	Θ	36.2	
	- 0.19536	P(4,3)	38.1	
	+ 0.19006	P(6,1)	41.5	

TABLE XVIII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{\nabla} P_1(W)_{24}$	− 2.1506	1	—	3.81 mb
	+ 0.037507	Z(2,3)	38.3	
	− 0.56964	I_2	40.9	
	+ 0.13488	P(4,1)	42.4	
	− 0.71057	P(5,3)	43.5	
	− 0.042880	H(3,2)	44.7	
	+ 0.086767	ΔP(2,3)	45.5	
	+ 0.043522	P(2,5)	46.2	
	− 0.12872	ΔP(2,1)	46.7	
	+ 0.022993	Z(4,3)	47.2	
	− 0.064773	ΔP(4,5)	47.7	
	+ 0.31139	P(6,3)	48.0	
	+ 0.18734	P(5,2)	48.7	
$\hat{\nabla} P_2(N)_{24}$	− 64.244	1	—	6.36 md
	+ 0.60646	I_2	12.2	
	+ 0.32158	P(6,5)	17.5	
	− 0.67871	P(6,3)	25.2	
	+ 0.33018	P(4,5)	32.0	
	+ 0.046018	Z(6,1)	37.2	

TABLE XVIII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_2(E)_{24}$	+ 325.56	1	—	4.94 mb
	- 0.26709	Θ	37.6	
	- 0.081931	P(5,2)	46.8	
	+ 0.023166	Z(2,5)	50.4	
	- 0.45468	P(5,3)	52.3	
	+ 0.048304	P(7,4)	53.9	
	- 0.20867	ΔP(5,4)	55.1	
	+ 0.19836	P(8,3)	56.1	
	- 0.034257	Z(8,1)	57.0	
	+ 0.17679	ΔP(7,4)	58.3	
$\nabla\hat{P}_2(S)_{24}$	+ 145.99	1	—	5.04 mb
	- 0.26983	Θ	38.4	
	- 0.49967	P(4,3)	46.3	
	+ 0.32725	P(6,1)	51.8	
	+ 0.018276	Z(2,5)	52.9	
$\nabla\hat{P}_2(W)_{24}$	- 46.677	1	—	6.49 mb
	+ 0.060007	Z(2,3)	47.9	
	+ 0.33367	ΔP(2,3)	50.8	
	- 0.39047	P(5,3)	53.2	
	+ 0.31970	P(3,2)	56.1	
$\nabla\hat{P}_1(N)_{36}$	+ 76.049	1	—	5.22 mb
	+ 0.038190	H(6,3)	15.8	
	- 0.14888	P(8,3)	19.3	

TABLE XVIII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\nabla\hat{P}_1(E)_{36}$	+ 137.49	1	—	4.08 mb
	+ 0.030748	Z(2,4)	27.0	
	- 0.19301	P(5,3)	33.6	
$\nabla\hat{P}_1(S)_{36}$	+ 4.6998	1	—	4.44 mb
	- 0.26981	Θ	32.8	
$\nabla\hat{P}_1(W)_{36}$	- 115.94	1	—	4.27 mb
	+ 0.035463	Z(2,3)	32.7	
	+ 0.20740	I_2	34.5	
	+ 0.087805	ΔP(2,4)	36.2	
	+ 0.13122	P(4,1)	37.3	
	+ 0.058064	P(2,5)	38.4	
	- 0.14256	P(5,3)	39.9	
$\nabla\hat{P}_2(N)_{36}$	+ 191.37	1	—	7.62 mb
	+ 0.047818	Z(6,5)	6.8	
	- 0.21617	P(8,3)	11.5	
	+ 0.26850	P(4,5)	15.2	
	- 0.33234	P(5,3)	20.5	
$\nabla\hat{P}_2(E)_{36}$	+ 457.91	1	—	5.42 mb
	- 0.12864	Θ	35.6	
	- 0.41085	P(5,3)	39.9	
	+ 0.038605	Z(2,5)	46.1	
	- 0.046042	ΔH(3,4)	48.2	
	+ 0.032752	Z(2,2)	49.7	
	- 0.043811	Z(8,1)	51.2	
	- 0.085536	P(8,5)	52.5	

TABLE XVIII (continued)

Predictand	Regression coefficient	Predictor	Accumulative % red.	Residual error
$\hat{\nabla P}_2(S)_{36}$	+ 32.968	1	—	5.45 mb
	− 0.28848	Θ	35.8	
	− 0.26972	P(5,3)	38.1	
	+ 0.24079	P(8,1)	41.9	
$\hat{\nabla P}_2(W)_{36}$	− 220.22	1	—	7.24 mb
	+ 0.067160	Z(3,2)	36.3	
	− 0.19233	ΔP(4,5)	38.8	
	+ 2.5151	I_2	40.5	
	− 0.043120	Z(8,5)	42.1	
	+ 0.038566	H(6,5)	43.9	
	− 0.31479	ΔP(8,3)	45.1	
	+ 0.096153	P(2,3)	46.1	
	− 0.022474	I_1	46.9	
	+ 0.22311	ΔP(2,2)	47.8	

TABLE XIX

ROOT-MEAN-SQUARE ERROR IN TESTS ON WINTER ANTICYCLONES, 1959/1960

(independent sample)

(a) TRC Equations

Area	Forecast interval hr	Predictands										
		$\hat{N}$	$\hat{E}$	$\hat{D}$	$\nabla\hat{P}_1$(N)	$\nabla\hat{P}_1$(E)	$\nabla\hat{P}_1$(S)	$\nabla\hat{P}_1$(W)	$\nabla\hat{P}_2$(N)	$\nabla\hat{P}_2$(E)	$\nabla\hat{P}_2$(S)	$\nabla\hat{P}_2$(W)
North America (140 cases)	12	2.01	2.01	2.09	2.27	2.24	2.25	2.66	5.39	4.41	3.30	4.29
	24	3.63	3.91	3.01	2.83	3.10	2.14	3.08	6.97	6.37	3.73	5.49
	36	4.67	5.36	4.85	3.25	3.84	2.17	3.79	6.60	8.13	4.22	5.92
Atlantic (94 cases)	12	1.89	1.83	2.07	2.26	1.76	1.87	2.14	5.76	3.79	2.37	2.91
	24	2.81	3.05	3.39	2.68	1.67	2.03	2.40	7.16	4.24	3.09	4.42
	36	3.97	4.29	4.52	2.95	2.10	2.20	2.36	7.89	5.07	3.82	5.49
Europe (55 cases)	12	1.56	1.81	2.15	3.57	2.89	2.19	2.70	6.11	4.31	3.88	5.43
	24	2.43	3.11	2.99	3.86	4.01	2.61	3.25	7.02	6.25	4.62	5.92
	36	3.46	4.01	4.73	4.12	4.16	2.87	3.33	9.77	6.60	6.02	6.51
Eurasia (78 cases)	12	1.30	2.29	2.96	3.49	3.96	4.16	2.92	5.05	5.05	5.19	4.51
	24	1.89	3.74	4.37	4.31	4.17	4.57	3.57	6.96	6.73	6.23	5.13
	36	3.05	4.55	5.67	4.64	3.64	5.29	3.60	6.31	6.04	7.46	6.81
Asia (130 cases)	12	1.65	2.35	2.40	2.03	2.04	1.67	2.19	4.35	3.15	2.34	3.66
	24	2.52	3.77	3.42	2.19	1.76	1.65	1.99	4.61	3.72	2.70	4.41
	36	3.49	5.27	3.99	2.38	1.86	1.93	2.59	5.40	4.23	3.03	4.79
Pacific (153 cases)	12	1.60	1.92	2.14	2.96	2.09	1.91	2.55	4.77	3.25	2.53	3.90
	24	2.42	3.57	3.02	3.27	2.60	2.36	2.92	6.10	3.95	3.25	5.50
	36	3.21	4.56	4.02	3.30	2.54	3.16	3.40	7.11	4.64	4.03	6.44

(b) Climatology

Area	Forecast interval hr	Predictands										
		$\hat{N}$	$\hat{E}$	$\hat{D}$	$\nabla\hat{P}_1$(N)	$\nabla\hat{P}_1$(E)	$\nabla\hat{P}_1$(S)	$\nabla\hat{P}_1$(W)	$\nabla\hat{P}_2$(N)	$\nabla\hat{P}_2$(E)	$\nabla\hat{P}_2$(S)	$\nabla\hat{P}_2$(W)
North America (140 cases)	12	2.65	2.54	2.65	3.37	3.66	2.71	3.92	6.67	7.65	4.83	7.31
	24	4.50	4.70	4.15	3.34	3.88	2.70	4.07	9.09	6.34	4.46	7.37
	36	5.96	6.61	5.65	3.33	4.49	2.58	4.64	9.56	9.76	4.51	7.63
Atlantic (94 cases)	12	2.30	2.71	2.43	2.96	2.36	2.46	2.97	7.48	5.46	4.22	5.72
	24	3.56	4.46	3.96	2.97	2.39	2.41	2.72	6.04	6.14	4.22	5.63
	36	4.99	5.94	5.23	3.06	2.51	2.33	2.45	6.03	6.34	4.09	5.56
Europe (55 cases)	12	1.90	2.16	3.10	4.67	4.81	3.22	4.21	10.37	6.57	6.49	10.50
	24	3.01	3.74	4.57	4.65	5.00	3.34	3.71	10.62	8.39	6.91	9.18
	36	3.82	4.99	6.29	4.92	5.29	3.46	3.63	11.22	8.43	7.24	8.89
Eurasia (78 cases)	12	1.65	2.31	3.56	4.64	4.54	5.53	3.59	8.32	8.99	8.73	6.89
	24	2.83	3.81	5.14	4.54	4.34	5.46	3.75	8.54	7.95	6.58	6.59
	36	3.76	4.79	6.68	4.98	4.18	5.09	3.56	9.21	7.26	8.02	6.67
Asia (130 cases)	12	2.18	2.69	2.60	2.17	2.91	1.62	2.95	4.93	6.17	3.20	6.20
	24	3.15	4.36	4.12	2.24	2.56	1.79	2.88	6.63	6.17	3.34	6.04
	36	4.17	6.07	5.35	2.48	2.44	1.92	3.07	6.28	6.02	3.52	6.13
Pacific (153 cases)	12	1.98	2.55	2.63	2.95	2.81	2.75	3.69	6.47	5.44	4.88	8.29
	24	3.30	4.54	3.59	3.13	3.04	3.16	4.21	6.64	5.62	4.96	6.85
	36	4.37	6.32	4.66	3.47	3.14	3.72	4.49	7.38	6.00	5.31	8.66

SECTION V

CONCLUSIONS

Equations for the pediction of 12-, 24-, and 36-hr anticyclone displacements and changes in central pressure have been derived for six areas. When applied to an independent data sample, the equations remained stable and yielded results that were generally superior to climatology.

Equations which were derived for pressure gradient forecasts surrounding anticyclone centers for the winter season appear to have potential applicability for describing the pressure pattern in the vicinity of the anticyclone center.

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13. ABSTRACT

This report presents results and equations for the 12-, 24-, and 36-hr prediction of anticyclone displacement and change in central pressure for the Northern Hemisphere. Separate sets of equations were derived for each of six areas. These equations yielded results that were generally superior to climatology when tested on independent data.

The technique employed is similar to that used previously in deriving cyclone equations, i.e., it features a moving-coordinate grid system for predictor tabulation, and a screening-regression analysis for the derivation of the prediction equations.

Additional equations were derived for winter anticyclones to specify the forecast difference in pressure between the anticyclone and each of eight surrounding grid points. Analysis of these differences leads to the construction of forecast pressure patterns surrounding thc anticyclone center; initial results from feasibility testing were encouraging.

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